MAY 7, 1951

Electrical World

Price 35 Cents

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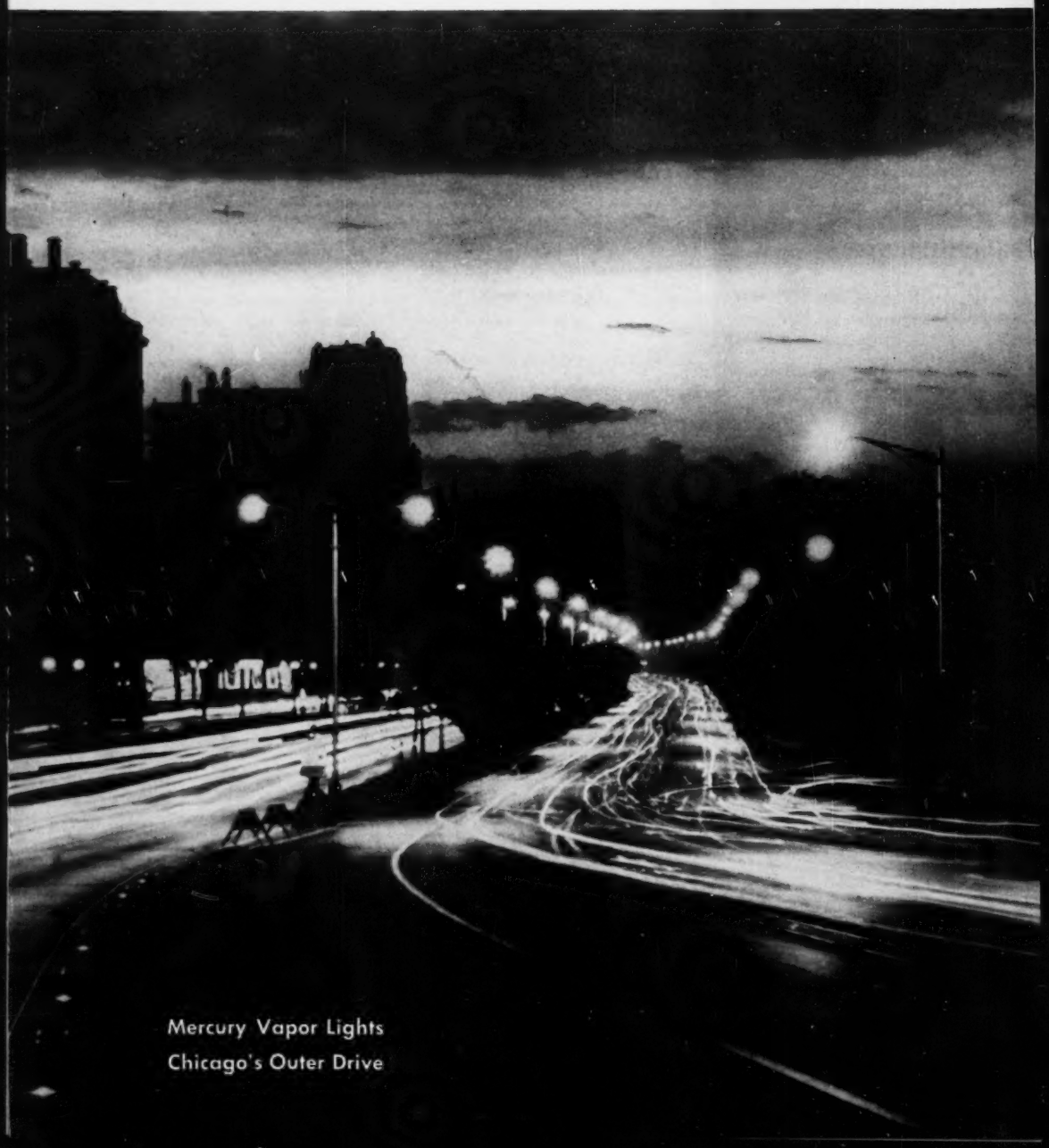


Mercury Vapor Lights
Chicago's Outer Drive

Emerson
RADIO and PHONOGRAPH CORP. says:

"Murray Breakers... safe, dependable protection for highly sensitive electronic equipment"

Murray Breakers always carry full load, regardless of temperature. They never need "derating."

Fully Magnetic!

PHONE CHELSEA 2-1800 CABLE ADDRESS EMPHONOCO NEW YORK CODES BENTLEYS ABC 5TH EDITION IM

Emerson
RADIO AND PHONOGRAPH CORPORATION
111 EIGHTH AVENUE NEW YORK CITY, 11

Murray Manufacturing Corporation
1250 Atlantic Avenue
Brooklyn 16, New York

Dear Sir:

Every Emerson Television and Radio Set undergoes a series of rigid tests using delicate electronic instruments.

During these tests a momentary short circuit or overload could damage or destroy the electronic equipment. A safe dependable means of circuit protection must be used.

It has been our experience that the Murray fully magnetic circuit breaker provides this safe dependable protection for the highly sensitive electronic equipment used in these tests.

We had tried various other types of circuit protection before we began using the Murray fully magnetic circuit breaker and none operated as well.

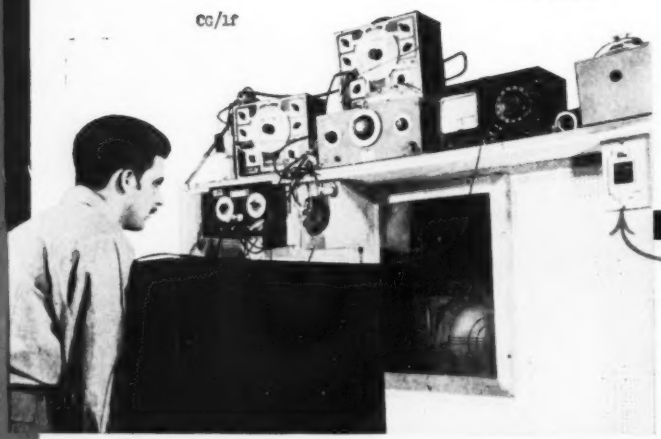
We would not hesitate to recommend very highly the Murray product.

Yours truly,
EMERSON RADIO AND PHONO.

C. Gustafson

C. Gustafson
Plant Engineer

cc/lf



Here is a typical Murray Breaker set-up used by Emerson in testing television sets

For the complete story on Murray Circuit Breakers, write for Bulletin 530

IF YOU WANT TO INSTALL THE BEST... specify Murray®

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Service Entrance & Meter Equipment • Magnetic Circuit Breakers • Switches • Current Limiting Reactors • Crows'nest Aerial Ladders

MEET THE AUTHOR

Gordon Simmons, who wrote the fine story about electric power in Korea in this issue, told us in a recent letter:

"I left Korea in 1948 and since then there has been a lot of shooting. However, I am willing to wager any amount of money up to a dime that the transmission lines and distribution system are still intact. I sincerely doubt if even the eagles' nests in those towers have been disturbed. It is probable that the rice paddies that dot the countryside have been damaged only a little. Rice paddies are poor places to stage a battle, and many of the poles and towers are planted in them.

"It is probable that engineers—American engineers—will some day direct the rebuilding of this country. However, no American will ever be able to persuade a Korean to do anything in other than the Oriental way. Educated Koreans have the I.Q. of the average American high school boy. They are artistic and literary, but not technically inclined. Their politeness and friendliness is amazing. They talk so much that Americans term it 'yackety yak.'

"Several of them offended my olfactory nerve. I asked my favorite interpreter why all Koreans smell of fish.

"'Please pardon my saying so, and I hope you will not get mad,' he replied, 'but all of you Americans smell of butter.'"

REBUILDING LINES

Mr. Simmons, who graduated from Georgia Tech in 1909, is married and says he loves to fish, was employed by the war department in Korea, and worked with other American engineers to rehabilitate the transmission and distribution installations. These, along with the power plants, had been manufactured and installed by the Japanese.

When he was in Korea there were "about 100,000 North Koreans on the 38th Parallel and the resulting tension was so strong that even a visitor could sense the coming conflict. Frankly I was glad to see the end of the work and to make my departure. . . ."

Before his Korean assignment, Mr. Simmons worked on the atomic energy plant at Oak Ridge and before that he had seen service in Ordinance Works in the Midwest and the South.

THE EDITORS

Electrical World

Published for 77 years for those engaged in the business of generating, transmitting, distributing or applying electric power

Vol. 135 No. 19 — May 7, 1951

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new OKOPRENE end seal

waterproofs multi-conductor cable terminals

One of the most common sources of difficulty with control, signal, and communication cables is at the termination of the over-all outside covering of the assembly. In most cases this is due not to any shortcomings of the cable itself, but to unsatisfactory methods of moisture-proofing the end of the cable.

Okonite now offers a waterproof End Seal which eliminates the most troublesome cause of such failures: moisture. The Okoprene End Seal is cone shaped (shown above), to receive filling compound, and snugly fits over any cable sheath from ¾" to 2" in diameter. Compound does not leak, and hardens to form a neat, permanent, moisture-proof seal.

Terminating by this means is a quick, simple operation. It eliminates the use of friction tape or windings which often allow moisture to be trapped under the outer covering.

Made from the neoprene formula used in rugged Okolite-Okoprene cables, the Okoprene End Seal provides the same high degree of permanence as the cable itself. It is mechanically strong, and resistant to light, air, ozone, oils and chemicals, as well as to moisture. It is adaptable to new or existing cables having lead sheath, interlocked armor, braided or other types of over-all coverings.

Use Okolite-Okoprene cable with the Okoprene End Seal on your next installation for completely trouble-free service. For details on the Okoprene End Seal, write for Bulletin EW-2091 to The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE SINCE 1878 insulated wires and cables

HOW SAFE

CAN YOUR LINEMEN BE?

All-over Protection

Your linemen are no safer than their equipment makes them. For surer protection, provide them with Salisbury rubber line hose, insulator hoods, protective blankets . . . rubber coats, gloves, and sleeves. Graybar has distributed these and other Salisbury safety accessories for many years. Linemen trust them.

HOT-LINE TOOLS

Graybar offers Chance hot-line maintenance tools individually or in complete sets. They incorporate the latest developments in equipment for repairing energized lines. Metal fittings are lightweight, strong, heat-treated aluminum alloy. Poles are laminated spruce. We can provide you with specialized tools of various types for performing all hot-line jobs safely and efficiently.

First for First-aid

Linemen's first-aid kits must be weatherproof, dustproof, easy to handle, and complete in the supplies they might need. That's why the M.S.A. kits available from Graybar are favorites. In addition to 10-unit and 24-unit all-weather kits, Graybar distributes pocket-size M.S.A. first-aid packets.

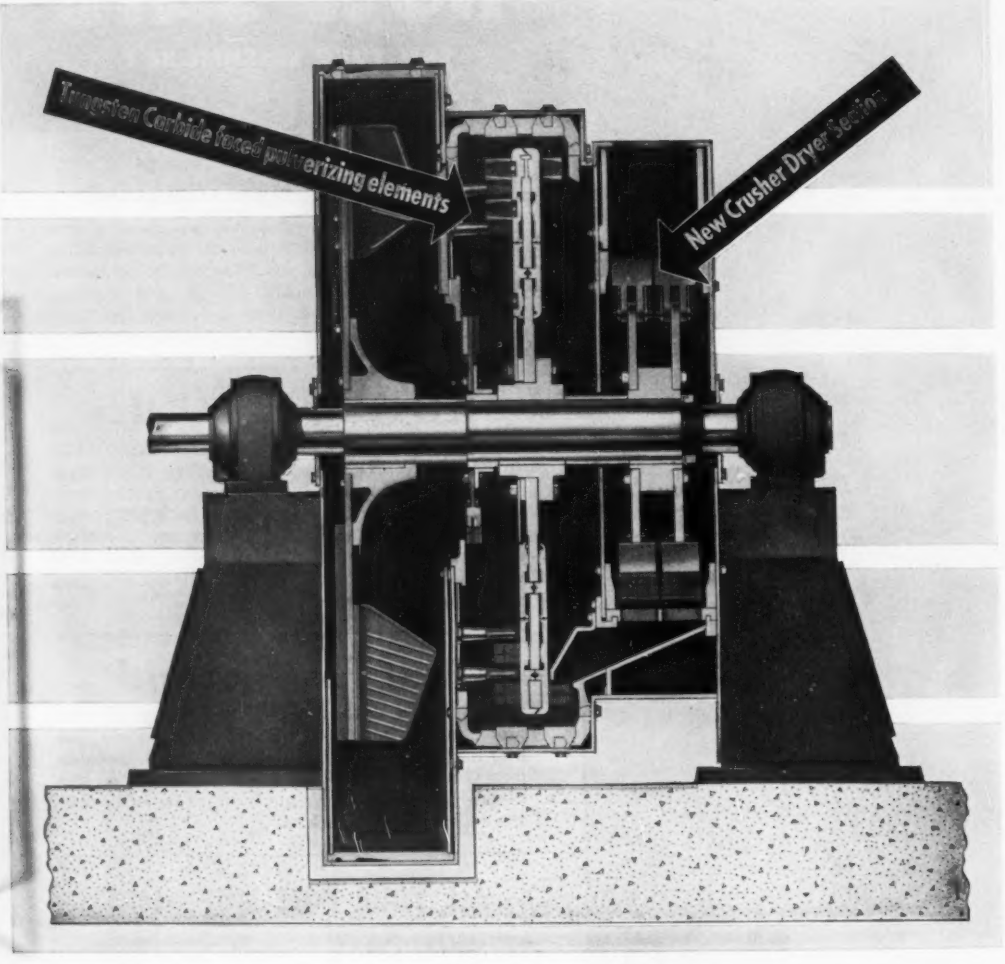
ALL YOUR POLE-LINE NEEDS

Your near-by Graybar warehouse is a convenient source of pole-line materials and supplies. You can rely on the local Graybar Representative to provide complete, accurate information about anything you require, as well as to arrange practical delivery schedules for items in short supply.

For special help on any problem "from the bottom of the hole to the top of the pole", talk with a Graybar Outside Construction Specialist. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.* 164-95

IN OVER 100 PRINCIPAL CITIES

This new Riley Pulverizer gives you



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BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

these added significant advantages

No capacity reduction with increase in moisture.

In the crusher dryer section where coal is crushed to a fine granular state, approximately 40% through a 50 mesh screen, representing about 5% of the work to be done, free moisture is evaporated from coal. The crusher dryer section acts as a flash dryer. Coal then enters pulverizing section where 95% of the work is done, completely free of moisture which would affect pulverizer performance and capacity. The crusher dryer section is designed with ample capacity for the highest moisture coals and as moisture is evaporated before coal enters the pulverizing section, moisture has no effect on pulverizer capacity or performance.

Tramp iron, iron pyrites and other foreign materials in coal rejected.

The crusher section of the pulverizer rejects tramp iron, iron pyrites and other hard foreign substances in the coal, preventing any materials from entering the pulverizer section which could cause damage.

Pulverizing elements faced with tungsten carbide.

Pulverizing elements are faced with tungsten carbide, assuring long periods of service without outage for maintenance and resultant low maintenance costs. Numbers of Riley pulverizers equipped with tungsten carbide faced parts have been in operation over two years without showing appreciable signs of wear, indicating at least several additional years of service before replacements are necessary. Over 50,000 tons of coal have been pulverized by a mill having a six-ton per hour capacity with indications that well over 200,000 tons will be pulverized before requiring replacement.

Fineness sustained over years of operation.

Because the life of the tungsten carbide faced pulverizing elements is so long, fineness of pulverization is maintained over years of operation. Tests on existing installations show no falling off of fineness after over two years of operation. No adjustments are necessary to maintain fineness.

Unusually high capacity per unit of space.

The improved Riley pulverizers have an unusually high capacity per unit of floor space and height, permitting their installation under crowded space conditions. A Riley Pulverizer having a capacity of 20 tons per hour with 50 grindability, high moisture coal is only 11'9" wide, 10'0" deep and 7'6" high and weighs only 46,780 lbs. Because of their lower weight and quiet vibrationless operation, heavy foundations are not required.

If you are interested in coal pulverizers, we believe you will find the article "THE USE OF TUNGSTEN CARBIDE IN COAL PULVERIZERS," presented at the fall meeting of the A.S.M.E., well worth reading. We will be happy to mail a copy to you without charge on request.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

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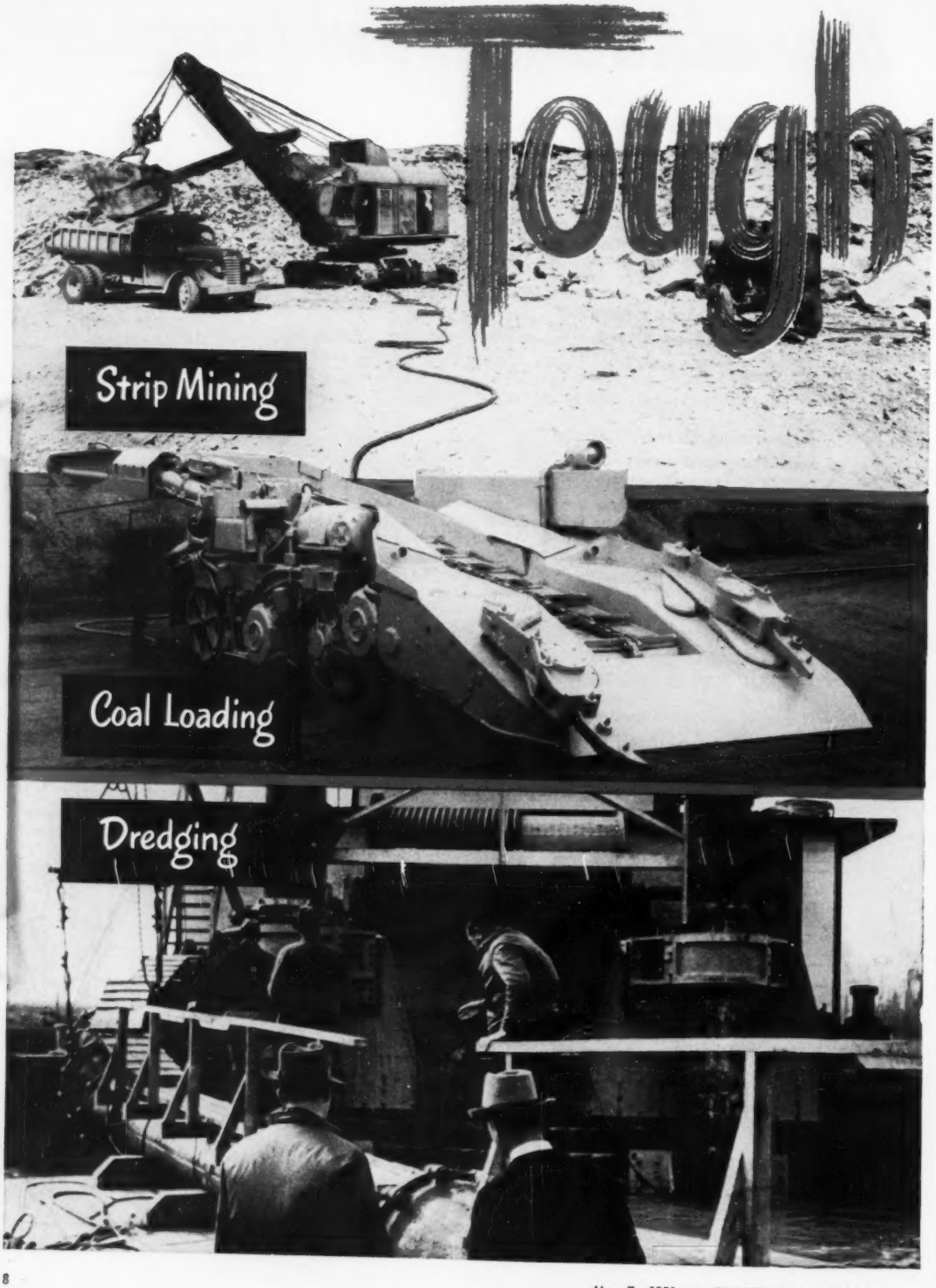
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS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Strip Mining
Coal Loading
Dredging

jobs all...

but they're easy for

AMERCLAD*

***the heavy-duty electrical cable and cord**

You'll find U·S·S Amerclad down in the mines, where it's relentlessly coiled and uncoiled and dragged over rails and ties. You'll find it on railroads for general utility use under all types of conditions.

You'll find Amerclad delivering power to the shovels in quarries and strip mines. There, it's reeled in and out all day long and hauled over sharp rock.

You'll find Amerclad under water, too . . . it's used on dredges that need electrical cable that can withstand great abuse. Actually, there's an Amerclad Cable or Cord for just about any tough operating condition you can name.

Amerclad Cable and Cord is jacketed with tough, resilient Amerprene. This quality jacket resists moisture, sunlight, mineral oil, grease, flame. It will not propagate fire. And it meets the requirements of ASTM D752.

Amerclad Cable and Cord can be furnished with PS Shielding,† the conducting rubber tape that prevents corona discharge because it will not pull away from the insulation like metallic shielding.

For more information, get in touch with your nearest American Steel & Wire Company office.

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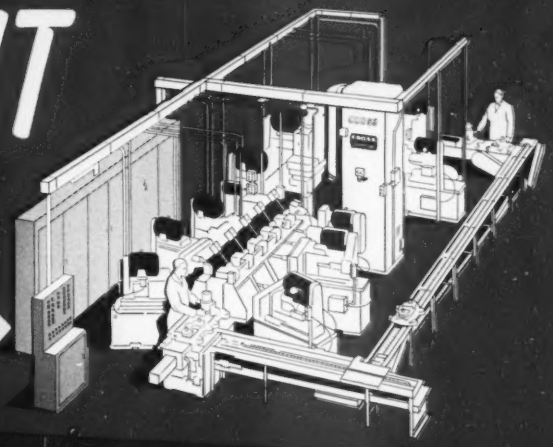
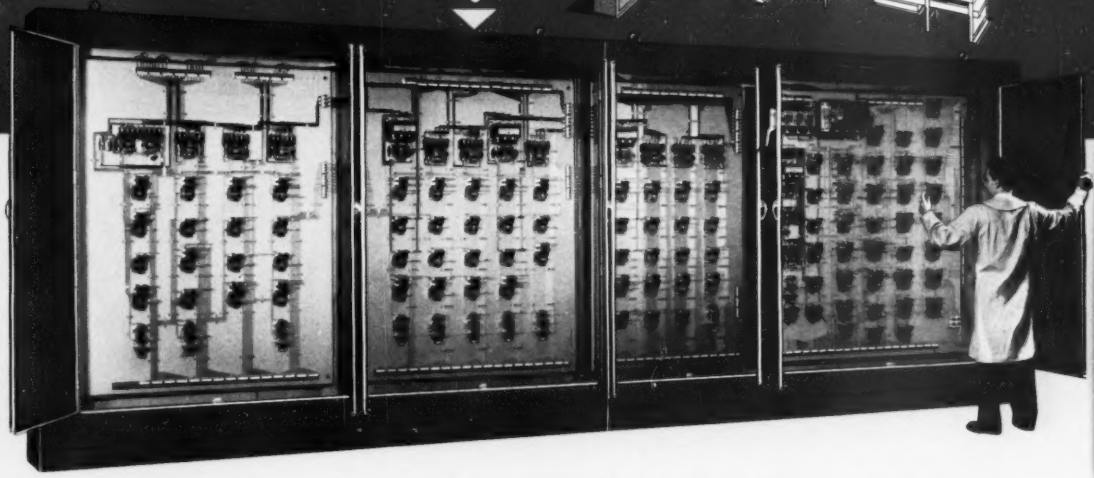
Built by the Makers of America's Foremost Heavy-Duty Truck

120 UNIT CONTROL PANEL . . .

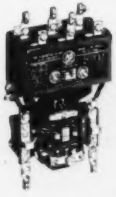




Panel Components

Bulletin 700 solenoid relay ... dependable ... consistent ... in closing and opening time.

Bulletin 709, Size 0, open type solenoid starter. Simple design assures trouble free operation.



Bulletin 709, Size 2, open type solenoid starter. A-B control is known for its reliable motor overload protection.

...integrates the operating sequence of this huge production machine...

This marvel of complete automatic operation . . . is the Cross Transfer-Matic Machine for machining automobile transmission cases.

Over one hundred individual operations are co-ordinated into an automatic machining sequence. Obviously, split second, trouble free operation of the control is essential to justify the cost of such a machine.

All Allen-Bradley solenoid contactors on this control board have but one moving part. There are no links, levers, pins, pivots, or bearings to corrode, stick, or affect the time of operation. Such simplicity guarantees trouble free performance.

The overwhelming preference of machine tool builders for Allen-Bradley controls is easy to explain. No other controls are so trouble free. Descriptive bulletin will be mailed on request.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

A-B Quality

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

451-M

TROUBLE FREE CONTROLS

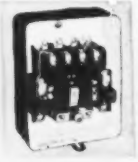
FOR SIMPLE OR COMPLEX SEQUENCE OPERATIONS

◆ SINGLE MOTOR DRIVES—The Cincinnati Shaper Company furnishes, as standard factory equipment on these machines, an Allen-Bradley solenoid starter with a Start and Stop push button station near the operator. While this is a simple, one motor drive, the Allen-Bradley Bulletin 709 starter does more than merely start and stop the motor.

Accurate and dependable overload protection is provided by two Resistotherm overload relays in the starter. White interior makes inspection easier.

The "no voltage" protective feature of these starters prevents the motor and machine from re-starting accidentally after line or fuse failure.

Complete protection is assured for man, motor, and machine at all times.

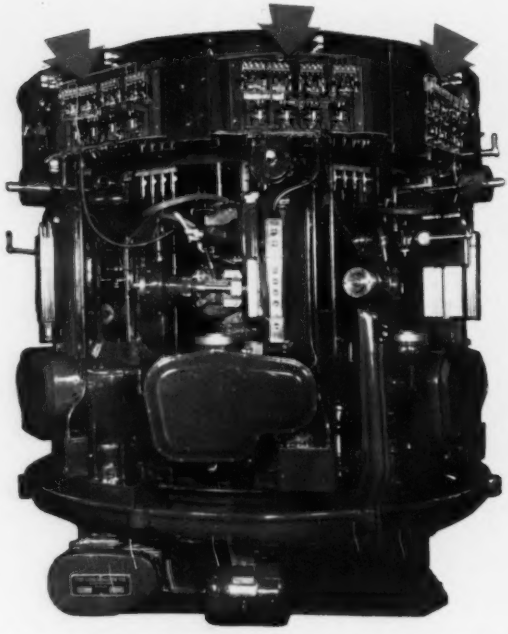


Allen-Bradley motor starters are available in various enclosures such as general purpose, water-tight, dust tight.

Allen-Bradley switches and starters are self insulated, and can be grouped closely in gangs on metal panels or in machine bases.

Keen machinery designers take full advantage of the precision performance and dependability of Allen-Bradley motor controls. The consistent timing of opening and closing provides precision co-ordination of machining operations. The result is increased output without loss of safety.

Let us show you, without obligation, how to use solenoid controls on your machines to best advantage.



◆ MULTI-MOTOR DRIVES—Lees-Bradner Company of Cleveland, Ohio, designed this 8-spindle gear hobbing machine with 27 electric motors. This automatic rotary tool required a complex system of automatic sequence controls. In the illustration, above, are shown some of the control panels around the top of the machine. The total control system required 118 Allen-Bradley starters, relays, limit switches, and push buttons.

Leading machine tool builders have standardized on Allen-Bradley solenoid controls, because they are so dependable and trouble free.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

451-M

A-B Quality

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

Long condenser tube life starts here!

CHASE ANTIMONIAL ADMIRALTY

(A patented alloy)

Thousands of installations since 1935 prove that Chase Antimonial Admiralty* adds years of service to condenser life.

Chase Antimonial Admiralty has *enough* antimony to resist dezincification. And antimony does not lessen resistance to other forms of corrosion . . . keeps tubes tough and rugged under heavy-duty assignments.

FREE BOOK — Send for the new Chase book discussing problems of corrosion in condenser and heat exchanger tubes, selection of proper alloy, and information on installing tubes. Fill in coupon below.

*U. S. Patent No. 2,061,921

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NEW BOOK includes Specifications, Weights, Dimensions and other data.

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Waterbury 20, Conn.

Please send me your free book on Condenser and Heat Exchanger Tubes.

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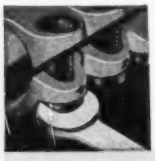
to do an important job

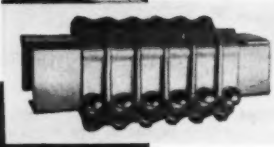
BETTER

special bus shapes . . .

We are in excellent shape to answer your needs. We've got T-connectors, couplers, bus supports, expansion joints. What's more, we've got them for channel, angle and square shape bus. Too, lots of utilities ask us to develop connectors for these special applications. We do it promptly, efficiently. Our engineering department is yours—for the asking. Our Representative too. Call him in on your next problem.

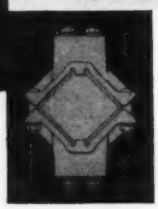
Oval recesses in bolt lugs and oval-shank bolts permit easy, single-wrench installation.





Strategic placement of ribs reinforces strength, provides wrap-around for better contact.

Strong bolts, properly placed for high pressure contact.



Internal lips guarantee accurate positioning on angle and channel bus.

BURNDY

connectors for special shapes

BURNDY, New York 54, N. Y.
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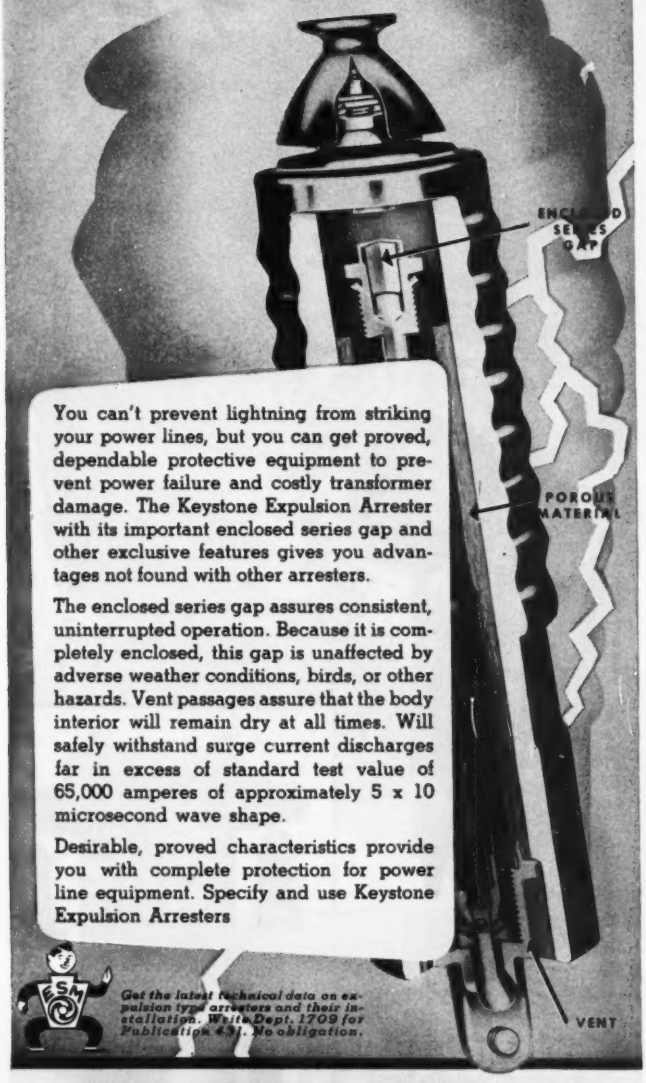
STRONG DEFENSE
Against Power Failure...
Keystone Expulsion Arrester



You can't prevent lightning from striking your power lines, but you can get proved, dependable protective equipment to prevent power failure and costly transformer damage. The Keystone Expulsion Arrester with its important enclosed series gap and other exclusive features gives you advantages not found with other arresters.

The enclosed series gap assures consistent, uninterrupted operation. Because it is completely enclosed, this gap is unaffected by adverse weather conditions, birds, or other hazards. Vent passages assure that the body interior will remain dry at all times. Will safely withstand surge current discharges far in excess of standard test value of 65,000 amperes of approximately 5 x 10 microsecond wave shape.

Desirable, proved characteristics provide you with complete protection for power line equipment. Specify and use Keystone Expulsion Arresters

Get the latest technical data on expulsion type arresters and their installation. Write Dept. 1709 for Publication 431. No obligation.

ELECTRIC SERVICE MANUFACTURING CO.

PHILADELPHIA 32, PENNA.

(Advertisement)

Ionizing and De-ionizing Air Spaces

by

J. R. McFarlin, Vice President
ELECTRIC SERVICE MANUFACTURING CO.

Were it not for phenomena of ionization and de-ionization lightning arresters of the expulsion type now known would not be possible.

The removal of electrons from the atoms or molecules of a gas—such as air, produces ions; these ions distributed throughout an air path ionize it and make it electrically conductive; if means are available to decrease or remove these ions from the air path, the path will be de-ionized and will become electrically non-conductive. These two phenomena control the basic functioning of expulsion type lightning arresters.

When a high voltage or lightning surge attempts to flow through an expulsion type lightning arrester, the air in the discharge path becomes ionized and therefore conductive; and because of this the surge can flow from line through the arrester to ground; so can any system current that may follow the surge discharge to ground. The arrester will necessarily have either an external or internal series gap as a part of the discharge path and regions around the gap electrodes will also have ionized fields in their vicinity.

In order to interrupt the flow of follow current, de-ionization in the discharge path will have to occur; this can occur in various ways; the most prolific de-ionizing means is due to heat developed by the follow current being transferred to the surface of the fibre elements in the path and causing the release of large quantities of relatively un-ionized gas; this by mixing with the ionized air reduces the ionic density of the former, increases the resistance of the discharge path and so decreases the magnitude of follow current to a point at which extinguishment occurs. The foregoing clearly illustrates the phenomena occurring in the parallel discharge paths of the Keystone Expulsion type arrester.

Since the air surrounding the enclosed series gap of these arresters becomes ionized during arrester operation, means must be taken to prevent diffusion of these ions in the air path between the gap electrodes and grounded parts within the porcelain housing; this is accomplished by the "Ion Trap" which greatly retards ion diffusion into this space; due to this delay the ionized air becomes de-ionized by cooling and recombination and the normal condition of the arrester is quickly restored. The "Ion Trap" is the means by which the highly successful operation of the enclosed series gap in the Keystone Expulsion type lightning arrester is secured.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

A new line of "CSP" Transformers, with wall-mounted, high-voltage bushings and "De-ion*" arresters. Easier to install, with improved pole clearance. New, extra-strength bushings have large unbreakable "Enrup*" knobs for fast, positive hand-tightening of leads. Convenient location of arresters and brackets facilitates adaptation to wye or delta systems.

*TM Reg. U. S. Rubber Co.

Eliminates 80%

of your service calls

Here's how a large midwest utility credits "CSP®" (Completely Self-Protecting) Transformers with greater savings . . . better personnel relations, too, because they alleviated a costly problem:

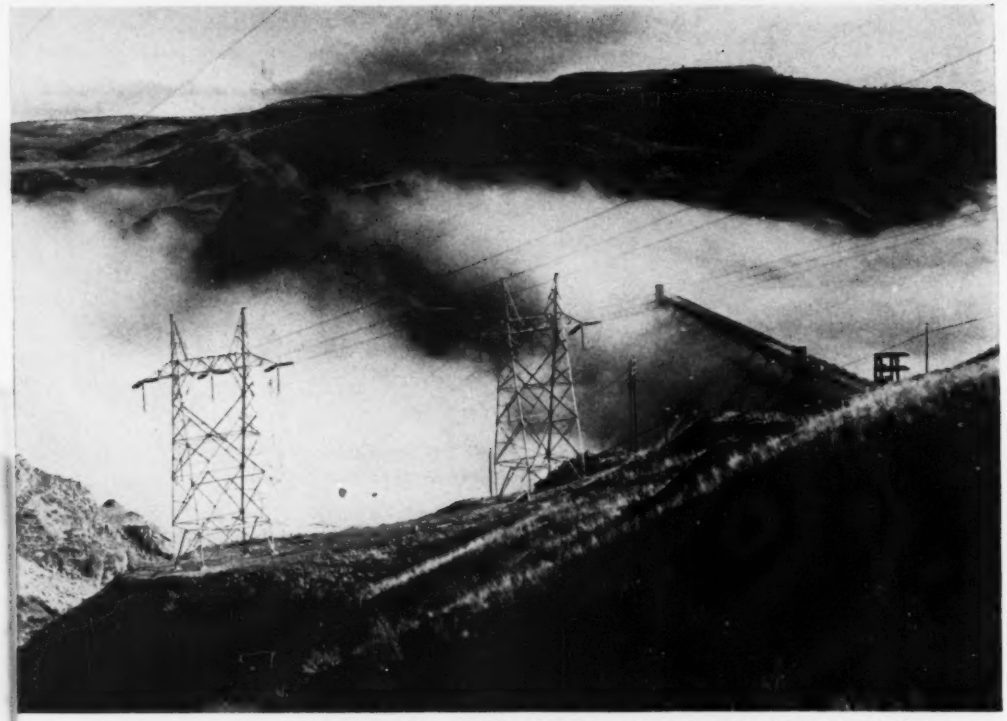
> "No one liked the necessity of calling out a full crew in the middle of the night to restore service on a conventional transformer because of a simple fuse outage. *'Midnight Nuisance'* is the term we applied. Our linemen used even stronger language.
>
> "Now, 'CSP' Transformers give ample warning of overload conditions. The Emergency Control provides reserve capacity to forestall outages until change-outs are convenient. Since we've standardized on 'CSP' Transformers, we've practically eliminated the *'Midnight Nuisance'*.
>
> "Our line crews prefer their greater freedom from emergency calls . . . and our comptroller appreciates the savings!"

One sure fact stands out: "CSP" Transformers cut service costs

Get the full story on how Westinghouse "CSP" Transformers, with built-in lightning and thermal protection, can cut distribution costs for you. Ask your Westinghouse representative for a copy of booklet B-4249-A, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, 30, Penna.

J-70568

We design and fabricate towers



Part of a group of thirteen 230 KV single-circuit transmission towers at Grand Coulee Dam, Washington. These towers were fabricated by Bethlehem for the Columbia Basin Project, Bureau of Reclamation, United States Department of the Interior. They have variable legs, and are from 50 ft to 60 ft to the crossarm, 20 ft from the crossarm to the ground wire.

for any locality...any load condition

Whenever you need single- or double-circuit transmission towers, either for new power lines or to lengthen existing lines, talk over the job with a Bethlehem man. We have had years of experience in transmission tower work, and are fully equipped to design and fabricate towers to meet your needs, regardless of location or weather conditions. What's more, our shops are well located, and have facilities for every phase of manufacture, including galvanizing.

We're busy, but not too busy to discuss transmission towers with you. Call our nearest sales office.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Fabricated Steel Construction

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Clean 'em

WITH A KEARNEY CONDUCTOR BRUSH

Seal 'em

WITH

KEARNEY AIRSEAL

- Seal Out Corrosion
- Eliminate Oxidation
- Insulate for Added Safety

It's the Modern Method of Connection Protection

171

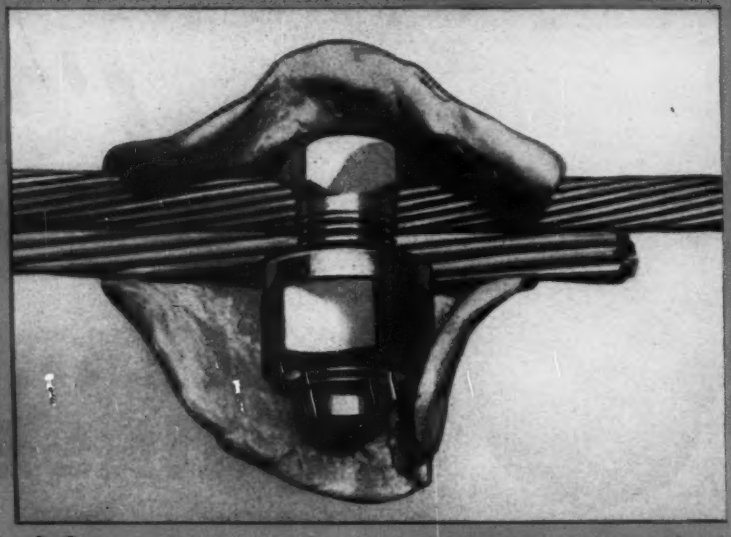
See following pages for more information about this KEARNEY development that is revolutionizing connection protection.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO

For GREATER PERMANENT PROTECTION to ALL CONNECTIONS... use

New KEARNEY AIRSEAL



What Is It?

Kearney AIRSEAL is a pliable, high-dielectric compound, chemically inert which, when applied to connections, forms a permanent seal against high resistance contaminations. Its high-dielectric strength (280 volts per mil, laboratory analysis) makes it particularly outstanding as an anti-corrosion agent and as an insulator where safety is an important factor.

CONNECTOR APPLICATION

Easily and quickly applied by moulding around the connector with the fingers. AIRSEAL maintains an efficient, high-conductivity connection because it SEALS OUT contaminating atmosphere.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

Specify KEARNEY Products...

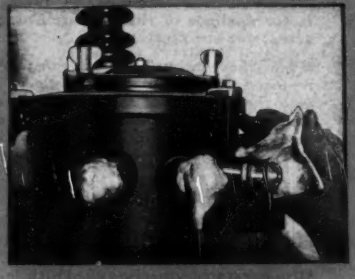
Clean Them First

A clean conductor is essential before making a connection. With a KEARNEY CONDUCTOR CLEANING BRUSH, complete cleaning is a simple operation. The brush is particularly effective for cleaning stranded conductors. A few quick strokes with the "V" shaped brushes thoroughly cleans even the areas between strands. Wire brushes can be rotated in fitting, or replaced when needed.

For live line work brushes are available with universal fitting, as shown, for all spline type poles. Also available with sure-grip wood handle.

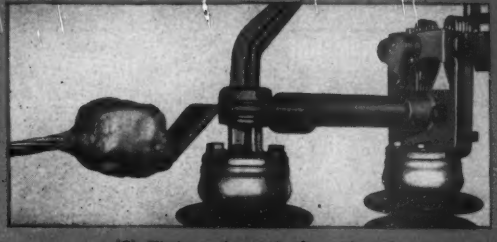
UNDERGROUND CONNECTIONS

The extreme corrosive agents in the earth have made ground connections a hazard to the successful operation of transformers and protective equipment. Because AIRSEAL will not age or deteriorate, even underground, it is ideal for sealing ground connections.



OTHER SUGGESTED APPLICATIONS

(1) Easily applied to irregular contours such as bulky terminal adapters;



(2) Eliminate hazard of accidental contact with transformer secondary terminals — or any other exposed terminal;

(3) Trouble caused by birds and animals on primary terminals of transformers and oil circuit recloser is eliminated when AIRSEAL is applied.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

Better Construction— *SAFER* Maintenance

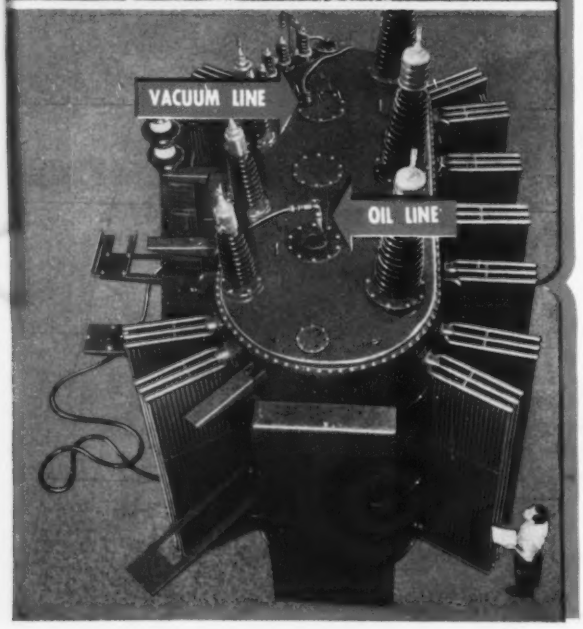
JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

Pennsylvania Factory Procedures Put Lower Power Factors into Power Transformers

A recent check of approximately 300 Pennsylvania Power Transformers indicated that the power factor values for these transformers were under 2%, with many under 1%. This fine record is due in part to Pennsylvania's excellent procedures for:

- **Drying out transformer core and coil units**
- **Filling transformer with oil**

These factory procedures, maintained under careful control at all times, are part of Pennsylvania's over-all program to provide America's Utilities and Industrials with the best power transformers that can be made.



Drying of Transformers

Pennsylvania's low-temperature, low-humidity drying equipment consists of two specially designed ovens and an elaborate activated alumina air-drying system.

Integral parts of this equipment are: (1) an air recirculation system with a capacity of 12,000 cubic feet per minute, and (2) a pre-cooler that lowers the temperature of the air as it leaves the oven and removes the moisture from the air by condensation. Transformers can be dried in 24 to 48 hours at relatively low temperatures — approximately 75°C. This fast, low-temperature drying prevents deterioration of the insulation during the drying-out period, and thus greatly increases the useful life of the insulation. Proper dryness of the insulation is determined by taking power factor readings of the insulation during the actual dry-out process.

While they are still warm, transformers are removed from the ovens and placed directly into their respective cases. The core and coil units are not permitted to cool off and absorb moisture. By keeping the insulation dry, the low power factor values are maintained.

Oil Treatment of Completed Transformers

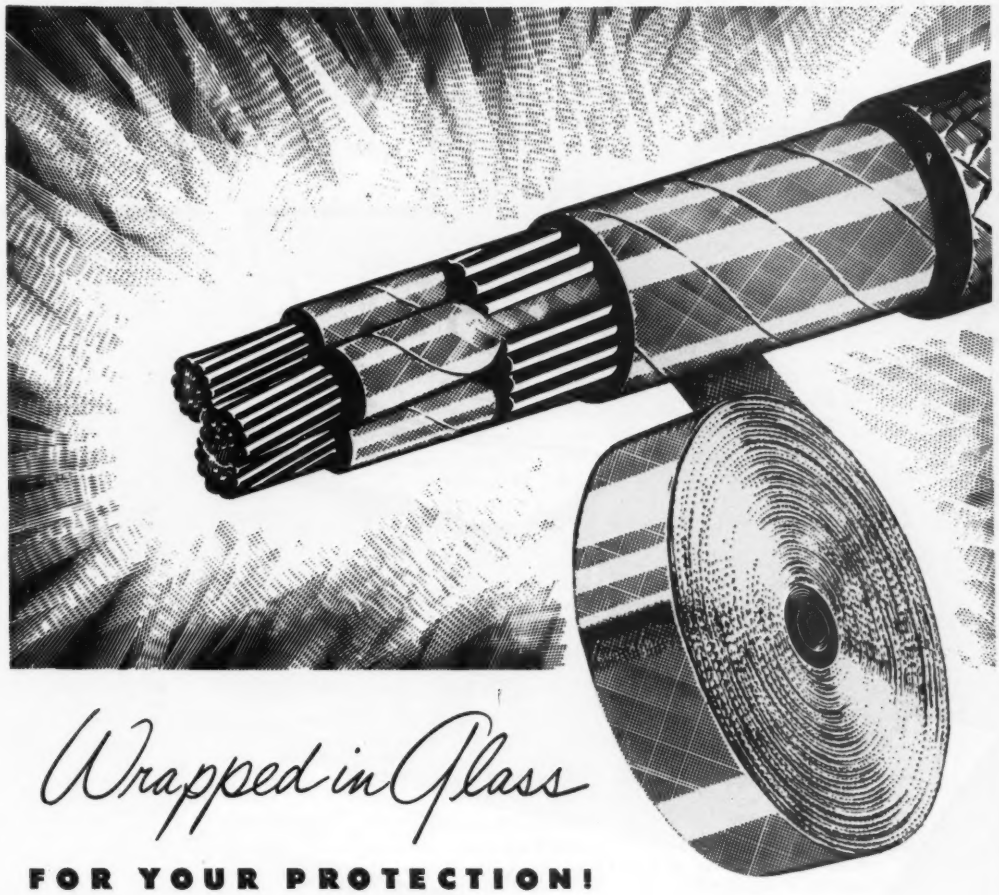
All power transformers are filled with de-aerated oil under vacuum in their own tanks.

Transformers designed for partial vacuum **are placed inside a large vacuum tank. By breaking up the oil into a fine spray as it enters the transformer tank, the air is readily removed by high vacuum.**

Transformers designed for full vacuum **are evacuated in their own tanks. Oil is brought into the transformer through spray nozzles while a high vacuum is maintained in the tank.**

Transformer being filled with oil while under vacuum. 30,000 Kva, 3 Phase, 60 Cycles, 154,000 Grd Y-115,000 Grd Y-124704 volts; Inert gas-oil seal system of oil preservation; tank braced for full vacuum.

Pennsylvania
TRANSFORMER COMPANY
Canonsburg, Pa. • Greater Pittsburgh District



Wrapped in Glass

FOR YOUR PROTECTION!

To protect you from power transmission failure . . . to save you the cost of frequent cable replacement . . . many top-flight cable makers are using varnished Fiberglas* fabrics as dielectric tape in power cable.

Used as primary and secondary insulation on conductors, tough, low-cost Fiberglas varnished tapes provide excellent electrical properties and, in addition, resist extreme moisture conditions.

Today, when continuing power transmission is a *must* in stepped-up production, it will *pay* you to specify Fiberglas components in power cable, as well as most other wires and cables.

OWENS-CORNING FIBERGLAS *Yarns*

*Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibrous glass.

FIBERGLAS IS IN YOUR LIFE . . . FOR GOOD!

NOTE: Because of increasing military and civilian demands for Fiberglas yarns, our customers are unable to get all they need. We are building new facilities to help meet these demands.

Owens-Corning Fiberglas Corporation
Electrical Sales Division, Dept. 858
16 E. 56th Street, New York 22, N. Y.

Please send your new booklet describing wires and cables insulated with Fiberglas Yarns.

Name_____

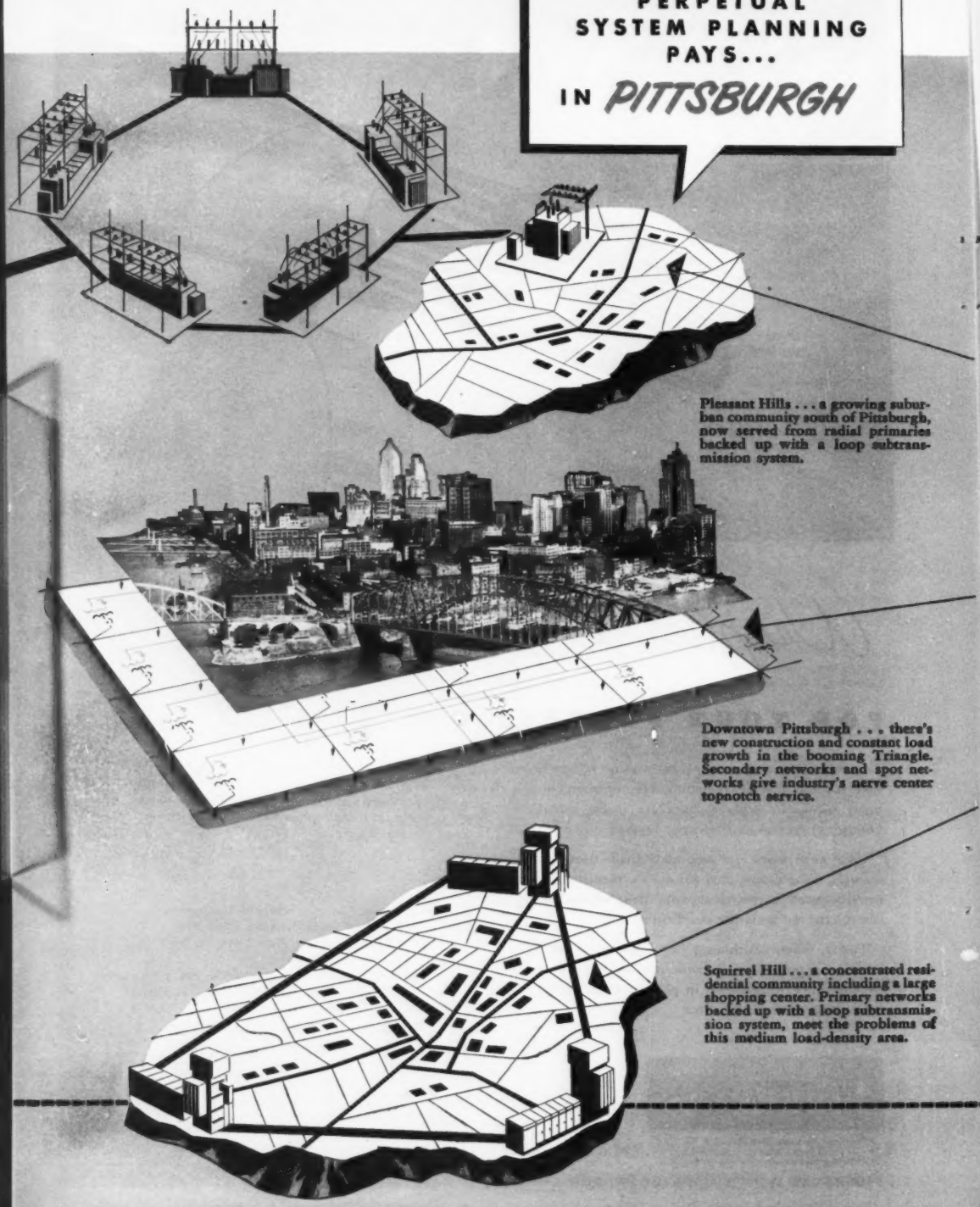
Title_____

Company_____

Street_____

City_____ Zone____ State_____

PERPETUAL SYSTEM PLANNING PAYS... IN *PITTSBURGH*



Pleasant Hills . . . a growing suburban community south of Pittsburgh, now served from radial primaries backed up with a loop subtransmission system.

Downtown Pittsburgh . . . there's new construction and constant load growth in the booming Triangle. Secondary networks and spot networks give industry's nerve center topnotch service.

Squirrel Hill . . . a concentrated residential community including a large shopping center. Primary networks backed up with a loop subtransmission system, meet the problems of this medium load-density area.

"Simplified Systems

meet our load growth...
reduce distribution costs"

In Pittsburgh you'll find all the benefits from almost 30 years of sound system planning. Main benefit—complete flexibility to meet all load growth economically.

Duquesne Light Company take full advantage of the latest advances in the design and reliability of modern unitized electrical apparatus. Small blocks of power are integrated to improve their own unique Service Continuity Standards without uprooting the entire system.

CASE I Greatly increased load with subsequent voltage problems necessitated improved service continuity and the elimination of line losses for this suburban area. Proper system planning utilized a nearby subtransmission loop by installing a unit-type single-feeder substation. Pleasant Hills gets adequate service and costly field-erected substations are eliminated.

CASE II Secondary networks have provided Pittsburgh's Triangle with the highest quality of service since 1926. Badly congested primary feeders and small transformer installations were eliminated. Duquesne Light Company also offers the spot network form of the system for large commercial buildings. Sound planning enabled Pittsburgh to grow without any basic changes in the system.

CASE III 4 kv primary networks were installed in 1949 to economically meet the Service Continuity Standards for this medium load-density area. Careful planning based on load growth, income potential and geographic conditions dictated the necessity for a primary network system. Now, service continuity is high and there's complete flexibility to meet any increase or change in load density.

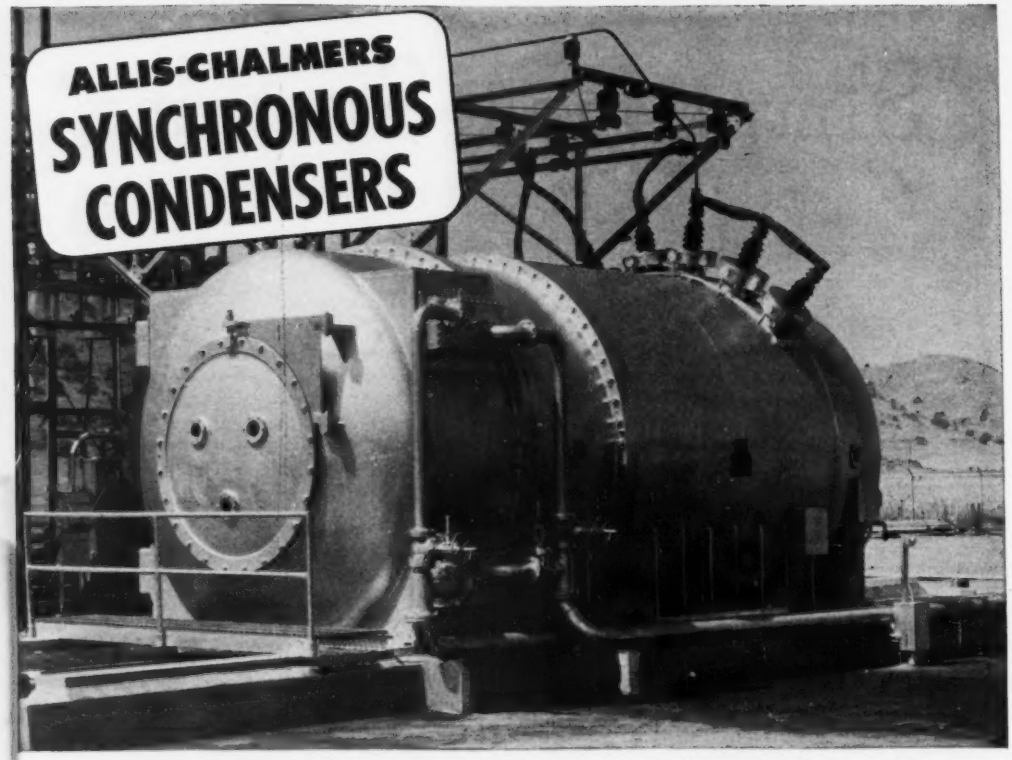
BECAUSE OF SOUND PLANNING, systems have been simplified, small blocks of power integrated, high service standards maintained, power distribution costs reduced. Westinghouse equipment and co-ordinated distribution apparatus have contributed to the ease and speed of change-over, dependability, and economy of this model operation. Use Westinghouse as your planning partner. Call us when you're ready to modernize. Start modern planning now!

J-97154

YOU CAN BE SURE.. IF IT'S
Westinghouse

SYSTEM PLANNING SERVICE

WESTINGHOUSE



Southern California Edison Stabilizes Transmission System

With Allis-Chalmers Hydrogen-Cooled Synchronous Condenser

THIS 40,000/16,800 KVA HYDROGEN-COOLED SYNCHRONOUS CONDENSER supplies reactive kva to regulate voltage and stabilize the far-flung transmission lines of Southern California Edison. It is one of several similar Allis-Chalmers machines built and building for large power systems with relatively long transmission lines. All are custom built to fill system requirements and incorporate proven Allis-Chalmers features which assure long service life and low operating cost.

Whatever problem you may have in electrical power generation, distribution, control or regulation, your Allis-Chalmers representative can help you. For further information on Allis-Chalmers synchronous condensers, write Allis-Chalmers, Milwaukee 1, Wis., and ask for Bulletin 05B7285. A-3345

ALLIS-CHALMERS

Straight Connectors
All good types— in a complete range of sizes.
Tees—
Multifit, numerous clamp types, bolted, yoke-and-nut tees, etc.
for the
Complete
line of Conductor Fittings--see the PENN-UNION Catalog
Grounding Connectors
For all combinations of pipe, rod, flat bar, braid, tubing.
Lugs—
Vitite, clamp types, with multi-slit sleeves; also soldering lugs, shrink fit, etc.
Service Connectors
Yoke-and-nut types; service entrance connectors.
And—
Meter cabinets, bus supports, cover lead connectors, cable taps, fuse clips, etc.
And—
Terminal blocks, bowl, solderless minal adapters, end clamps, etc.

You can find the exact fitting you need in the Penn-Union Catalog— practically every good type, in a complete range of sizes. The few here can only suggest the variety.

We also have thousands of other types— new designs are constantly being added. When you need a special conductor fitting for an unusual service, our engineering staff is always ready to help you.

And— Every Connector is Dependable. When you use any Penn-Union fitting, you are sure of a connector that's reliable mechanically and electrically— carefully designed, thoroughly tested, and manufactured under rigid engineering supervision.

Preferred by Leading Users, who have found that "Penn-Union" on a fitting is their best guarantee of unfailing service.

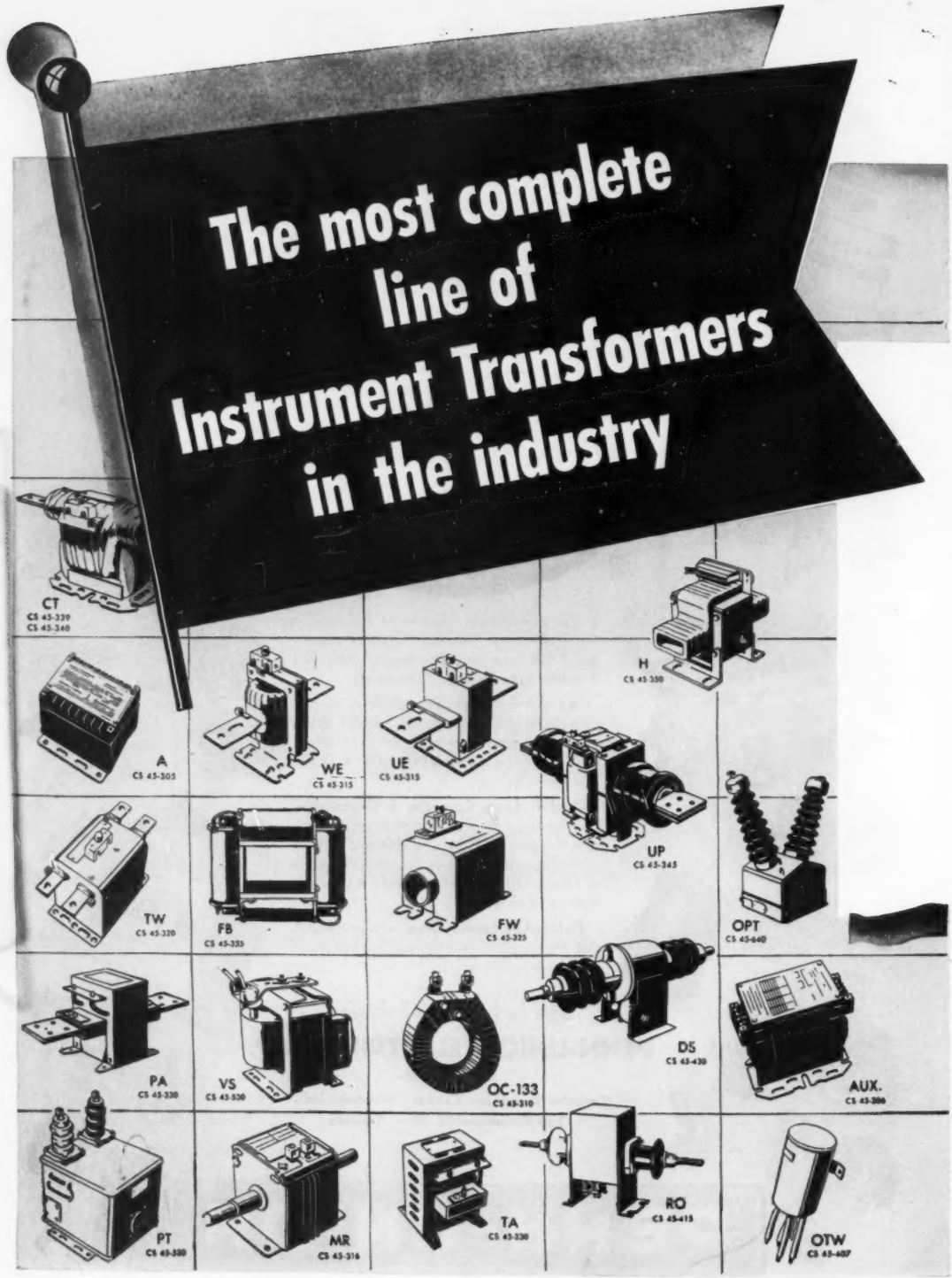
Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORP.
Erie, Pa.

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

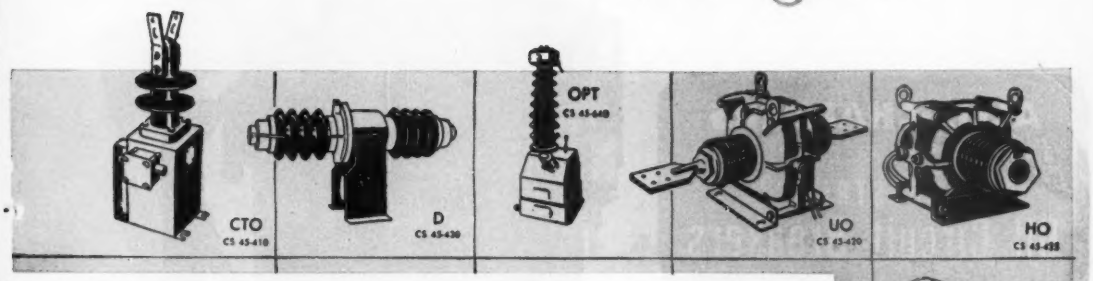
THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION


The most complete line of Instrument Transformers in the industry
CT
CS 45-339
CS 45-340
A
CS 45-305
WE
CS 45-315
UE
CS 45-315
H
CS 45-390
UP
CS 45-345
OPT
CS 45-640
TW
CS 45-320
FB
CS 45-335
FW
CS 45-325
PA
CS 45-330
VS
CS 45-530
OC-133
CS 45-310
D5
CS 45-430
AUX.
CS 45-306
PT
CS 45-380
MR
CS 45-316
TA
CS 45-330
RO
CS 45-415
OTW
CS 45-407

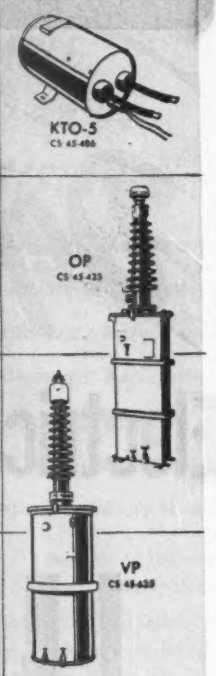
YOU CAN BE **SURE**.. IF IT'S

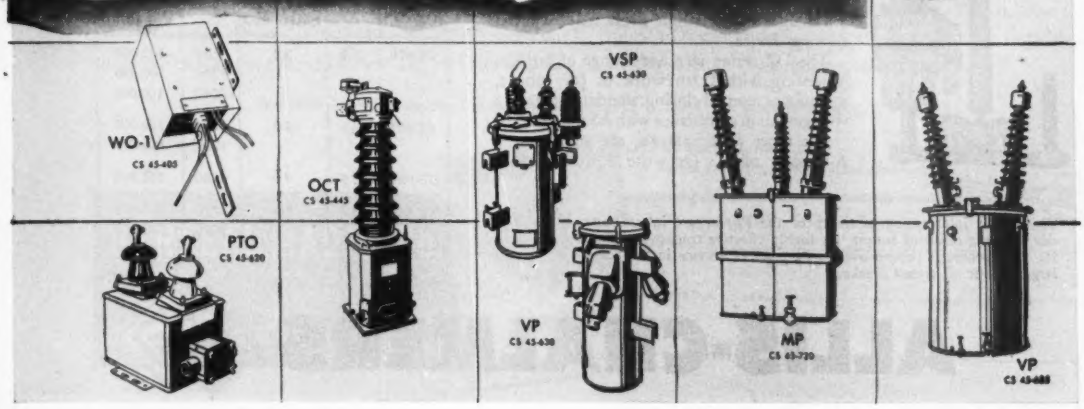
Westinghouse



Solve all your instrument transformer problems quickly, easily! Turn to the Westinghouse salesman. He has the most complete line in the industry . . . for metering, relaying, current, potential or auxiliary applications. For further information on any of the transformers illustrated, contact your nearest Westinghouse office, or write for Catalog Sections by listing the "CS" numbers desired. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70573

Westinghouse
INSTRUMENT TRANSFORMERS



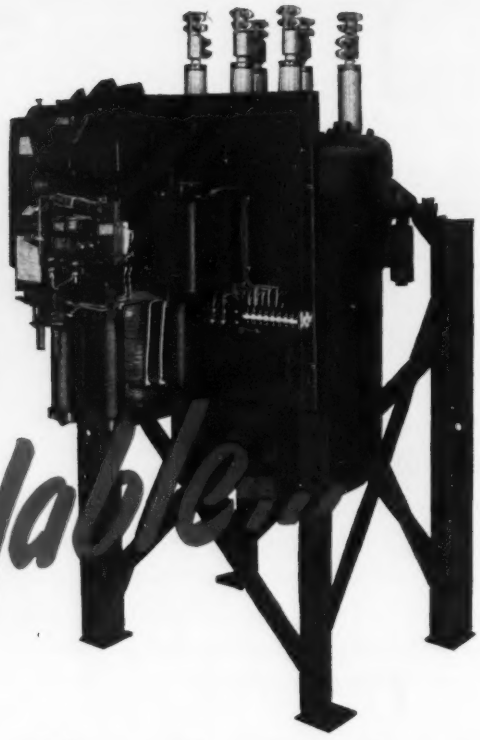


ALLIS-CHALMERS

TYPE DZ-LARGE INDOOR

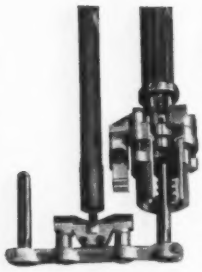
INDUSTRIAL

Oil Circuit Breakers



Dependable...

Electrical Protection for Industry



YOU CAN GET full electrical protection for equipment in your plant with the 8-cycle DZ oil circuit breaker. It is liberally and compactly designed to meet your requirements economically.

Mechanically and electrically trip-free, it combines reliability in operation with the advantages of the single break *Ruptor* interrupting device.

The DZ comes in a wide range of ratings. Mounting with framework or for cubicle, solenoid or manual closing, standard operating voltages, all in accordance with ASA standards.

For more information, see your nearby A-C sales office. Or write Allis-Chalmers, Milwaukee 1, Wis. for bulletins 71B6129D (DZ-60B, DZ-100B, DZ-200B) and 71B6179C. (DZ-40B) A-3381

Ruptor is an Allis-Chalmers trademark.

TYPE	RATED K.V.	MINIMUM KV AT RATED KVA	RATED AMPS.	KVA INT. CAPACITY
DZ-40B	7.2	2.3	600	100,000
			1200	100,000
			2000	100,000
DZ-60B	13.8	4.0	600	150,000
			1200	150,000
DZ-100B	13.8	4.0	1200	250,000
DZ-200B	13.8	6.6	1200	500,000
			2000	500,000

The circuit interrupting efficiency of the *Ruptor* arc interrupting device is the result of simple, yet highly effective contact structure. Its effectiveness is proved over many years of service in these and larger power oil circuit breakers.

ALLIS-CHALMERS

for ACCURATE, RELIABLE and SIMPLE MEASUREMENTS of INSULATION RESISTANCE

★ Generators, Motors and Transformers ★ Single Conductors, Cables and Capacitors ★ Changes in Volume Resistivity with Temperature and Humidity ★ Paper Capacitors ★ Dielectric Absorption in Insulation of Electrical Machinery ★ Long Sections of High-Voltage Cable ★ Slabs of Insulating Material ★ Multi-Wire Cables ★ Taking Charge-Current Curves Over Time Intervals from One Second to Many Hours

The G-R Type 544-B Megohm Bridge is ideal for all of these measurements. Fundamentally it is a Wheatstone bridge with a very sensitive vacuum-tube voltmeter balance-indicating circuit which absorbs negligible amounts of power.

Over the range from 100,000 ohms to 10,000 megohms the effective scale-length is 35 inches! The accuracy of measurement varies from ±3% from 0.1 megohm to 100 megohms, to ±10% from 1,000 megohms to 10,000 megohms.

Two power supplies are available: an a-c unit delivering d-c test voltages of 500 volts and 100 volts to the bridge, and a battery-supply model of 90 volts. The voltage applied to the unknown is very close to constant, regardless of the value of the unknown resistance.

Type 544-B Megohm Bridge for A-C power supply.....$340 for battery supply.....$250

For Detailed Information write for this Informative Booklet

GENERAL RADIO Co.

275 Massachusetts Avenue, Cambridge 39, Mass

NEW YORK 5 · CHICAGO 5 · LOS ANGELES 38

Name_____ A

Street_____

City_____ Zone_____ State_____

Fistful of Savings

More and more utilities are proving that Kaiser Aluminum triplex service drop cable means material and installation cost savings of 20 to 40 per cent over conventional open wire construction.

This is possible because Kaiser Aluminum triplex cable combines three conductors in one assembly: Two neoprene insulated conductors supported by one bare neutral as messenger.

Thus it needs fewer accessories. No insulators are needed. Its light weight and low wind and ice loading mean lower tensions on houses and poles. It can be installed faster, easier.

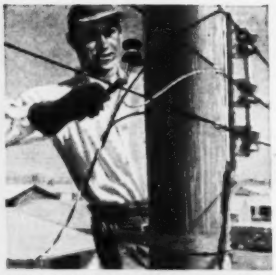
Also, the single cable allows increased clearances, fewer contacts with trees.

Defense requirements necessarily limit supplies. However, we are producing at full capacity and are expanding our facilities to make possible a vast increase in the supply of primary aluminum.

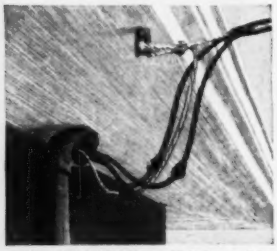
For more facts, call us now. Kaiser Aluminum & Chemical Sales, Inc., Oakland, California. Plant office: Newark, Ohio. Sales offices in principal cities.

Kaiser Aluminum

Setting the pace . . . through quality and service



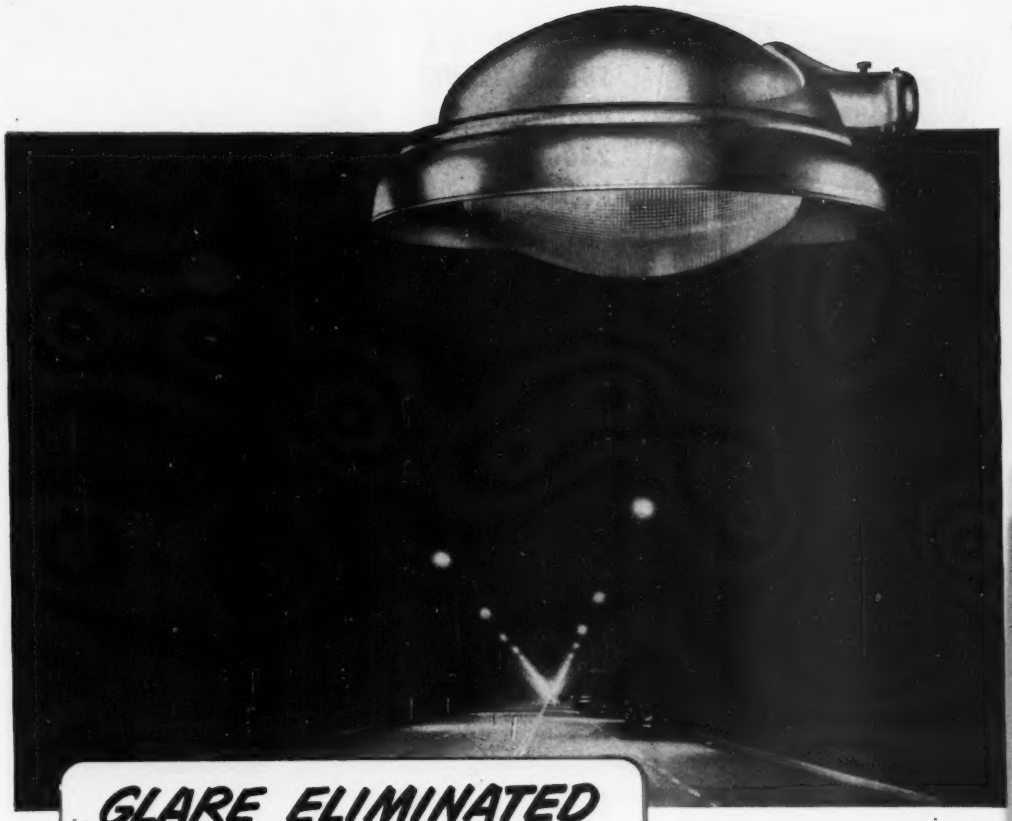
EASILY HANDLED—Triplex cable is light in weight, free-stripping and clean to handle. Thus it can be installed easily and quickly.



FEWER ACCESSORIES—Triplex cable requires only one house knob instead of three. Reduces cluttered appearance on houses and community pole lines.

SECONDARY USES—Kaiser Aluminum triplex cable is being installed in secondary lines in many cities. Aluminum duplex cable is being used on street lighting circuits.

TECHNICAL INFORMATION—Assistance in the use of any Kaiser Aluminum weatherproof cable will be readily provided by your nearby Kaiser Aluminum service engineer. Call now!



GLARE ELIMINATED

without sacrificing efficiency

California state highway specifications called for: *"high roadway brightness, with* additional shielding *to prevent distracting glare* . . . at a no more than 2% loss in lighting efficiency."

A special shield for the Westinghouse OV-20 mercury-vapor unit minimized glare and showed these results: *less than 2%* loss in efficiency.

With thousands now installed, they have discovered that this is also one of the easiest street lighting systems to maintain. Relamping is a one-hand operation, because of the hinged construction. Routine cleaning is speedy.

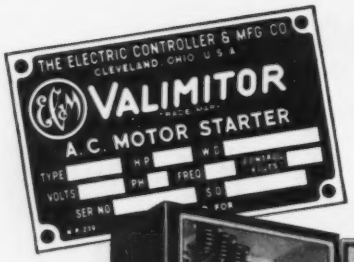
What's more, this unit provides lighting distribution patterns for both wide and narrow highways.

It will pay you to investigate the Westinghouse mercury-vapor street lighting systems. Send for B-3876-A, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-04300

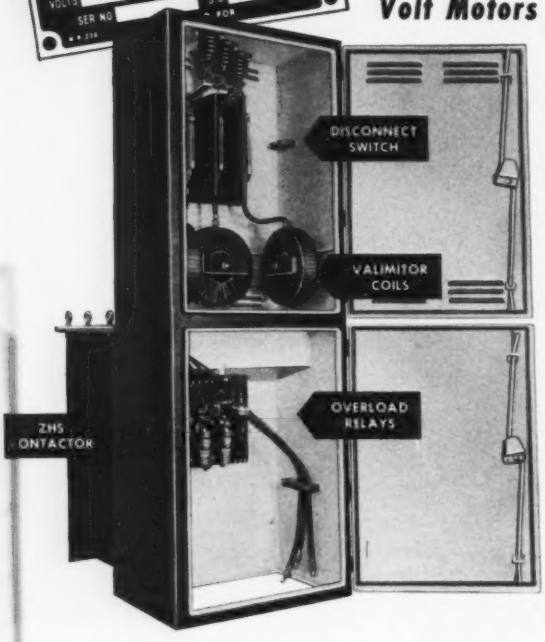
YOU CAN BE SURE.. IF IT'S

Westinghouse

PLANNED LIGHTING SYSTEMS



Complete SHORT CIRCUIT Protection for 2300-4600 Volt Motors



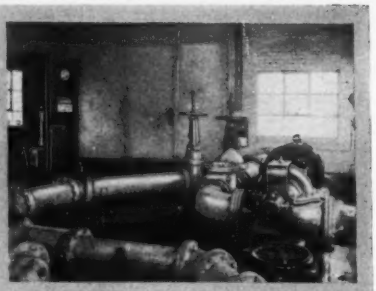
- ★ unlimited by available KVA
- ★ unrestricted by starting currents
- ★ no fuses or fuse-replacement time-outs
- ★ reduced damage should a fault occur

Unlike any other method of short circuit protection, these EC&M VALIMITOR (volt-ampere-limitor) Starters for 2300-4600 volt motors, limit the fault current to 25,000 KVA (steady state current) or less. This is based on a bus of infinite KVA but the inherent characteristics of every system will further reduce actual fault currents.

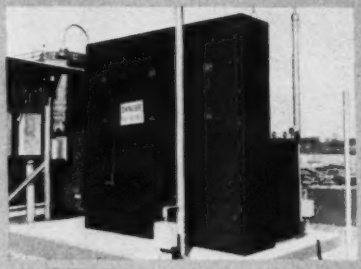
Should a fault occur, damage to motor, wiring, etc., is limited—the entire circuit clear back to the power house is protected by this limitation of the fault.

You get *cushioned starting, too,—an inherent feature of VALIMITOR Starters, automatically effective during the starting period.*

Write for Complete Facts—Ask for T9-117 REPRINT BULLETIN



PUMP DRIVE in Metal Processing Plant



OUTDOOR INSTALLATION in Oil Refinery

CEMENT KILN DRAFT FANS

STEEL MILL AIR COMPRESSOR

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

More use from used poles

Many reclaimed utility poles and crossarms are good for many additional years of service when Monsanto Penta (pentachlorophenol) is applied by the simple dip method, such as shown in the illustration. Penta treatment is *easy, economical, efficient.*

Dirt and old preservative residues are removed from the surfaces before the poles are dipped. Then poles are lowered into a vat and left overnight or longer. The vat, which is 14 feet deep, also is used to treat crossarms and lumber.

Properly formulated penta is a *clean* treatment. It protects poles and crossarms from decay due to fungi and from attack by termites and other wood-boring insects. Penta, a chemical with stability, gives uniform, long-lasting protection. It is insoluble in water and does not leach. Penta treatment does not change dimensions of wood nor corrode common metals.

For detailed information on applying Monsanto Penta to poles, crossarms or other wooden structures, contact the nearest Monsanto Sales Office or write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

KEEP YOUR TREATING PLANT BUSY!

There are so many places in which you can lower maintenance costs by using penta-treated wood, that it often is practical to keep treating facilities working around the clock. Here are a few of the numerous applications:

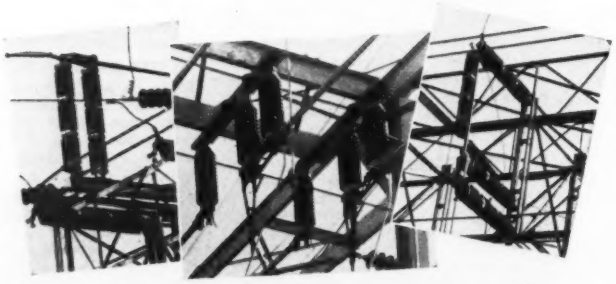
Poles and crossarms • Planks covering underground cables • Transformer platforms • Sills and plates • Joists and girders • Screeds and subflooring • Flooring • Roof planks • Platforms and decking • Posts and fences • Cooling towers • Millwork • Guardrails • Truck beds • Construction timbers.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS — PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

FOR 20 YEARS . . .



The Lapp Station Post, incorporating the same design and performance characteristics as the Lapp Line Post, boasts an operating record unmatched by any other insulator for switch and bus support use.

. . . DELIVERING AN EXTRA MARGIN OF OPERATING SECURITY . . . ELECTRICAL AND MECHANICAL

No insulator ever had a more severe baptism-under-fire, nor a better chance to prove its merits. The Lapp Line Post, the "radical" insulator design, promised to stand up where conventional insulators fail. It got its chance. In "trouble spots" from coast to coast. Its operating record has been built largely on installations in lightning areas . . . where stones and bullets . . . or atmosphere contamination . . . made insulation by conventional design next-to-impossible. The record now goes back 20 years. Long enough to prove our right to say . . . no puncture . . . no cracking . . . no cleaning . . . no radio interference . . . greater resistance to stones and bullets . . . better performance under arcover.

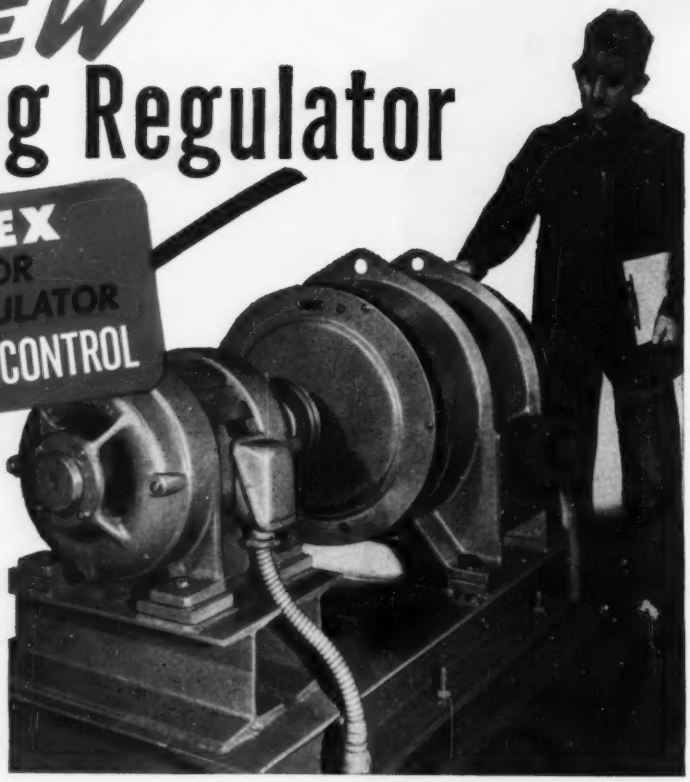
If you want to eliminate service interruptions . . . reduce manpower requirements . . . save maintenance costs . . . it's time to rewrite your standards and specifications, to call for Lapp Line Posts.

Lapp

LAPP INSULATOR CO., INC., LE ROY, N.Y.

NEW Rotating Regulator

REGULEX
GENERATOR VOLTAGE REGULATOR
POWER PLANT CONTROL



1 Minimizes the effect of disturbances caused by sudden load changes and fault conditions.

2 Controls generator excitation so as to increase safe operating limits.

3 Provides proper division of reactive current between synchronous machines operating in parallel when a cross current compensator is applied.

4 Provides accurate, sensitive voltage control.

5 Functions without hunting.

6 Provides high rate of excitation voltage response to restore voltage to normal as quickly as possible after a disturbance.

7 Provides alternate manual control of excitation without disturbance of the existing excitation.

WHEN SELECTING generator voltage regulators for your power plant, consider these seven big advantages of new *Regulex* control. Remember that *Regulex* control gives you pin-point accuracy while improving service continuity by reducing outages for maintenance. You can use *Regulex* generator voltage regulators on alternators, synchronous condensers and dc generators. Call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin for further information. A-3298

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS AC

Order Telegraph Systems

The Allis-Chalmers Order Telegraph System is accurate and reliable . . . can be depended upon even during station power failure because it uses the dc bus for its power source. An alarm system operates until the order is returned correctly. Five or ten inch semi-flush dials for switchboard mounting. Use it to transmit orders between switchboard and turbine room.

Automatic Speed Control for Boiler Draft Fans

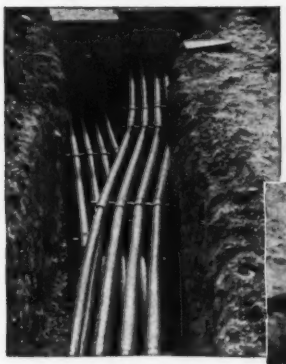
Draft fans operate at exactly the required speed for perfect combustion when Allis-Chalmers Type 257 Liquid Rheostats are used with wound rotor drive motors. They are application engineered to provide straight line speed characteristics . . . automatic wide range stepless speed control. Use electric, pneumatic or hydraulic pilot devices. Ask for leaflet 14S7544.

"Well protected cables keep power flowing

That's why I specify

ORANGEBURG"

—says the Utility Engineer



ORANGEBURG STANDARD

. . . installed with concrete encasement. The preferred conduit for banks of three or more ducts.

ORANGEBURG NOCRETE

. . . installed without concrete encasement. Its extra heavy wall makes NOCRETE practical for many single or double duct runs.

Here are some of the ways by which Orangeburg® Fibre Conduit protects cables and wins the confidence of Utility Engineers.

• Will not corrode. Lasts indefinitely. • Impermeable wall and tight joints prevent corrosive ground waters from entering. • Lays faster and at lower cost than any other type of conduit. • Low coefficient of friction keeps pulling tensions on cable to minimum. • Protects cable sheath from abrasion when pulled in—also from wear during cable movement due to alternate expansion and contraction with changing loads. • Resists acids, alkalis, grease, oil. • Light, easy to handle and tool on the job. • Tough, resilient—will not crack or break when properly handled.

Nearly 19,000,000 More Potential Users

Since 1940, the national population has shot well beyond 150,000,000. There are now nearly 19,000,000 more people than there were ten years ago calling on industry and business to produce the goods and provide the services they demand. This, of course, greatly expands the need of electrical services. Ever-increasing amounts of the *vital fluid* must be kept flowing to industry, business, all service institutions and homes.

But only fully protected cables can transmit power unfailingly. Realizing this, more and more public utilities and municipalities are turning to Orangeburg Conduit. Why? Because the Utility Engineer knows . . . as he has known for 58 years . . . that Orangeburg provides a time-defying raceway for the permanent protection of electrical services underground.

ORANGEBURG MANUFACTURING CO., INC., ORANGEBURG, N. Y.

ORANGEBURG FIBRE CONDUIT

STANDARD Installed with Concrete

NOCRETE Installed without Concrete

Graybar ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

GENERAL ELECTRIC SUPPLY CORPORATION

Branches and Stocks in Principal Cities

MICAH

The Most Valuable

"Stopshort"

In Any League

But be positive you sign the *RIGHT* player for *YOUR* club! "MICAH" means MACALLEN MICA . . . and *THAT* means championship insulation.

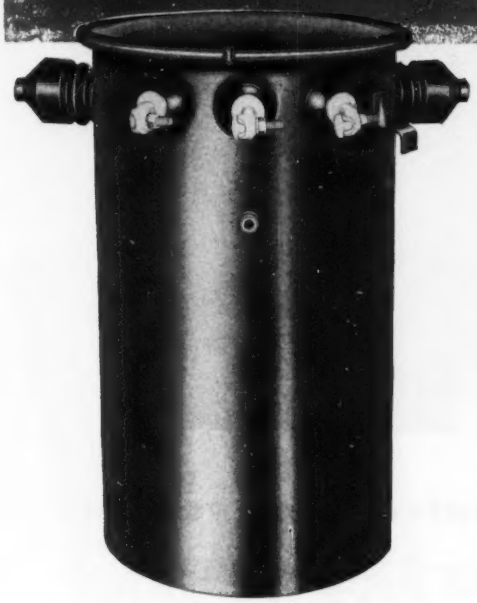
when you think of MICA, think of MACALLEN

MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

THE MACALLEN COMPANY 16 MACALLEN STREET • BOSTON 27, MASS.
CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.

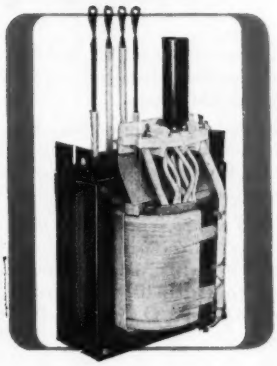
WAGNER Form W TRANSFORMERS



New Shur-Seal cover prevents oil contamination

Wagner Form W Transformers are now provided with the exclusive Wagner SHUR-SEAL Cover . . . a *positive* seal that completely prevents oil contamination caused by injurious "breathing" of atmospheric air, moisture and dust particles during the daily load cycle.

The SHUR-SEAL Clamping ring maintains uniform pressure *around the entire periphery of the cover* to assure sealed-tank construction, airtight as a welded tank, but permits removal of cover, if necessary, by loosening a *single* stainless steel bolt.



The Form W core is made of cold rolled oriented grain transformer steel, carefully heat treated to obtain the lowest practical magnetic losses. The preformed core is assembled in a shape that provides a path for the magnetic flux parallel to the grain of the steel.

Form W

Means small size, light weight, excellent performance

Wagner Form W Transformers are exactly right for modern distribution systems. They are liberally designed—yet small in size and light in weight to permit greater ease of handling, storing, and mounting on poles.

Electrical performance is excellent—core and copper losses are relatively low . . . regulation at both 100% and 80% PF is good . . . exciting current is extremely low . . . short time overload capacity is high. Form W gives the type of service that you need.

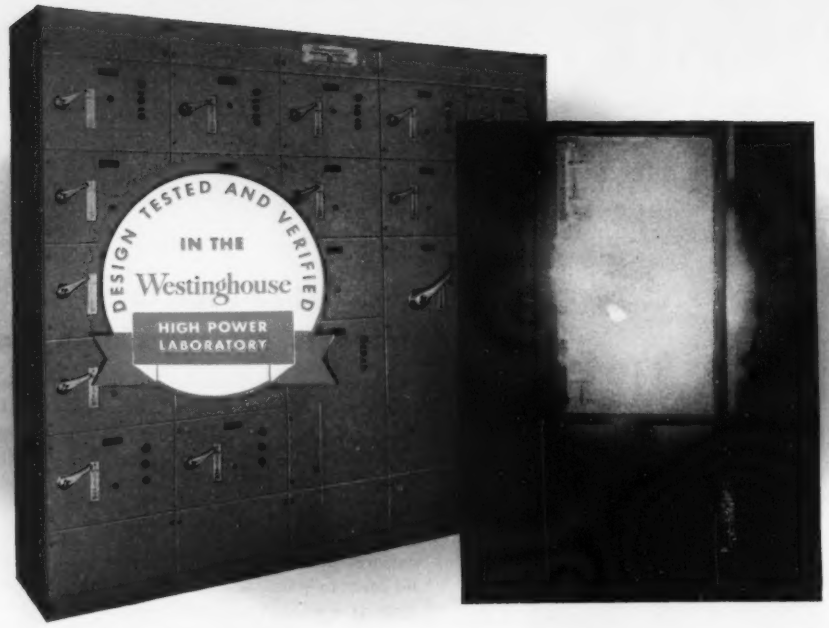
Investigate Wagner Form W Transformers today.

T31-4

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES



What other control center gives you this

TESTED PROTECTION

Your control center holds the life line to your motors. Such guardianship demands top-quality construction, at *every* point, to provide complete protection.

Westinghouse Control Centers are built to give you this protection and laboratory tested to prove it:

1. **Complete Baffling** of each starter unit in Westinghouse Control Centers is a typical example of the fruits of this thorough testing at the Westinghouse High Power Laboratory. When interrupting a short circuit on a starter unit of non-baffled design, tests showed the short circuit could spread throughout the entire structure. Each Westinghouse starter unit is completely baffled to prevent these explosive chain reactions. Unusual arcing is localized if faults occur.

2. **Ample Interrupting Capacity** is another tested feature of Westinghouse Control Centers. Each starter circuit breaker has a capacity of interrupting a fault current of not less than 15,000 RMS amps.

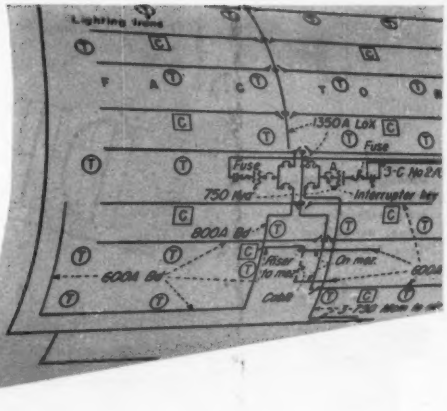
3. **Sturdy, Self-Supporting, Tight Structures** also are on the list of Westinghouse quality features. Each panel is built to stand by itself and to protect the internal electrical equipment.

You will want to know of the many other points of quality that make up Westinghouse Control Centers. Write for your copy of Booklet B-4213 which contains all the facts. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-27010

YOU CAN BE SURE.. IF IT'S
Westinghouse

CONTROL CENTERS



FOR EASY FISHING...

choose your conduit from Central's Big 4

You'll reduce hang-ups and kinked wires when you fish through Central Conduit. It's smooth and uniform inside, and makes-up tight to reduce hang-ups at joints.

Four types of Central Conduit let you pick the best one for each job. There are 3 types of full-weight rigid . . . "Cenlaco" with a hot-dipped galvanized finish inside and out . . . "Central White" with electro-galvanized zinc outside and black enamel inside . . . "Central Black" with black enamel inside and out . . . and "Central EMT", light-weight sturdy steel conduit that's electrogalvanized outside, black enameled inside.

All Central Conduit is approved by Underwriters' Laboratories and the National Electrical Code . . . and backed by our 111 years of tubular production experience.

Demand for Central Conduit far exceeds the supply . . . but your supply house is filling orders as quickly and as fairly as he possibly can.

SPANG-CHALFANT

Division of The National Supply Company
GENERAL SALES OFFICE: Grant Bldg., Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

Uptegraff DRY TYPE TRANSFORMERS

Easy to Install · Economical Dependable

Uptegraff type DB Dry Type Transformer with ventilated weatherproof enclosure, for indoor or outdoor service. Sizes, 7.5 to 500 KVA.

Type F Dry Type Transformer, for protected cabinet mounting, or indoor service. Standard sizes, 0.25 to 15 KVA. Can be built in larger sizes.

Completely enclosed type E Uptegraff Transformer. Available in sizes from 0.25 to 10 KVA, for indoor service. All Uptegraff transformers are built and tested in accordance with the applicable standards of the N.E.M.A., the A.S.A., and the A.I.E.E.

The built-in dependability and economy of Uptegraff Dry Type Transformers comes from engineering and manufacturing skill and experience. All Uptegraff Dry Type Transformers are made with durable, non-inflammable Class B insulating materials. Available in standard types and sizes from 0.25 to 2000 KVA, and in special styles to meet individual specifications when required by the application.

Some of the more popular Uptegraff "Specialty" Dry Type Transformers are illustrated here. Write for a copy of bulletin No. 126, which gives full information on all types and sizes of Uptegraff Dry Type Transformers. If you wish detailed data and prices, give capacity required and service for which the transformer is intended.

R. E. UPTEGRAFF MANUFACTURING COMPANY

SCOTTDALE, PENNSYLVANIA

Makers of POWER • DISTRIBUTION • INSTRUMENT • SPECIALTY TRANSFORMERS

NEW APPLETON V-51 SERIES

CONVERTIBLE VAPORTIGHT LIGHTING FIXTURES

WITH MALLEABLE IRON BODIES
100 WATT OR 150-200 WATT UNITS

EXCLUSIVE UNIT ASSEMBLY!

TWIST
—IT'S ON!

Never before a vaportight lighting fixture so safe, so efficient, so easy to install . . . so economically serviced and maintained!

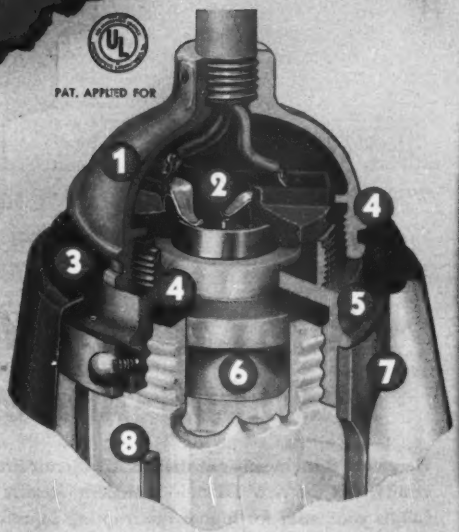
Combined in an exclusive "Unit Assembly," receptacle, globe and guard are detachable as a *single unit* instantly, without tools! Re-lamping or cleaning becomes safe, swift and simple. One trip up the ladder to exchange assemblies, and the job's done!

This outstanding new V-51 line includes 18 different types of rugged malleable iron bodies for pendant, ceiling or bracket mounting. Each body takes both 100 Watt or 150-200 Watt "Unit Assemblies." Each body, except bracket types, is grooved to mount four reflector styles in three different sizes. This *complete interchangeability of parts* permits the assembling of 256 complete fixtures, using only 32 basic components.

Reflector is quickly attached or removed for cleaning without tools—thanks to exclusive neoprene rubber ring attachment. Shock-absorbing socket in "Unit Assembly" permits the use of standard lamps where costlier mill-type lamps were formerly used.

For full details on this great new fixture, write for Bulletin 5-A.

PAT. APPLIED FOR



NEW—INSIDE AND OUT

Sectional View Shows Outstanding New Design and Operating Principles.

1. Malleable iron fixture body.
2. Connecting block with spring leaf contacts.
3. Neoprene rubber ring holds reflector.
4. Vaportight gaskets.
5. Globe and guard adapter body.
6. Shock-absorbing socket.
7. Snap-on type guard.
8. Vaportight globe.

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1705 Wellington Avenue • Chicago 13, Illinois

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Mission St. • ST. LOUIS, 227 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Ave. • ATLANTA, 724 Boulevard, N. E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street CINCINNATI, 626 Broadway • HOUSTON, 709 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9.

Resident Representatives: Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.

Export Representatives: International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

MALLEABLE IRON CONDUIT FITTINGS

APPLETON

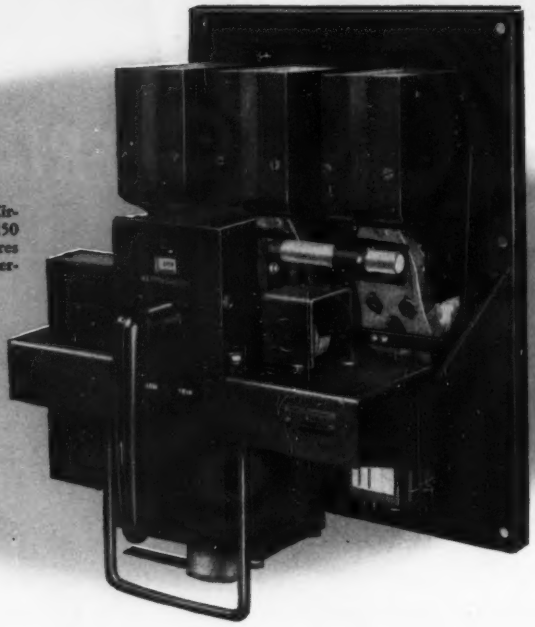
OUTLET BOXES AND SWITCH BOXES

ELECTRIC

INDUSTRIAL LIGHTING EQUIPMENT

PRODUCTS

EXPLOSION-PROOF FITTINGS • REELITES



The DB-50 Low-Voltage Air Circuit Breaker, 600 volts, a-c; 250 volts, d-c; 100 to 1,600 amperes continuous; 50,000 amperes interrupting rating.

NOW...the PROVED DB Breaker Design in 50,000-Ampere Interrupting Rating

Here's the third member of the DB Air Circuit Breaker family. It's the new DB-50—a modern breaker that fulfills your need for higher interrupting capacity on low-voltage circuits.

Of the same uniform design as the DB-15 and DB-25, the DB-50 includes . . . complete shielding for extra safety . . . subassemblies that are removable as complete components . . . a rigid all-metal mounting base. General construction and operating characteristics are similar to the DB-15 and DB-25 breakers.

To match the improved performance offered by the new 50,000-ampere breaker, a series tripping device has been developed which provides all the basic delay characteristics required for motor circuit protection or for use in selective tripping systems. By use of filtered air as the escapement medium and by incorporating adjustable features to all pickup and delay settings, a tripping device has been provided which is both versatile in application and precise in operation.

Booklet B-4740 contains complete information on the DB-50. The DB-15 and DB-25 units are covered in B-4067. For copies, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60747

See "Electrical Proving Ground" . . . *the dramatic story of the Westinghouse High Power Laboratory in sound and color motion picture. For details, see your Westinghouse representative, or write Westinghouse, Film Division, Box 868, Pittsburgh 30, Pennsylvania.*

DESIGN TESTED AND VERIFIED IN THE Westinghouse HIGH POWER LABORATORY

YOU CAN BE SURE.. IF IT'S Westinghouse

WESTINGHOUSE

"DE-ION" CIRCUIT BREAKERS

TYPE DB

not one...but all three

...all three electrical tapes are important to meet the specifications of the electrical trade!

DUTCH BRAND *Friction* Tape

DUTCH BRAND Friction Tape is one of the most widely used friction tapes on the market today. The electrical group finds it easy to use and accords it high preference. It is a quality tape that is long-lasting, it sticks tight, it tears straight, wraps neatly and does not ravel. Its tensile strength exceeds requirements, and the careful choice of materials and manufacturing process result in excellent aging qualities. The most important point . . . you can buy and use it with confidence.

DUTCH BRAND PLASTIX Electrical Tape

DUTCH BRAND **PLASTIX** is made with the tape "know-how" of more than forty years' experience. **PLASTIX** is superthin with high dielectric resistance . . . conforms readily to irregular surfaces . . . stands up under severest conditions . . . resists water, oil, acids, alkalies and corrosive chemicals.

It is available in regular .007" thickness and heavy-duty .010" thickness. The .010" **PLASTIX** has all the general characteristics of regular **PLASTIX** except it is heavier for heavy-duty work such as winding heavy cables, heavy electrical harness and for use in tape winding machines.

DUTCH BRAND *Rubber* Insulating Tape

DUTCH BRAND Rubber Tape is well known to the trade for its top insulating quality. It has been one of the outstanding electrical tapes in the field for years. To use it is to appreciate this quality for it fuses instantly without heat, insulates perfectly, stretches readily and contains no corrosive chemicals. DUTCH BRAND Rubber Tape resists up to 18,000 volts through a single thickness. It is strong, durable and easy to use.

When used with DUTCH BRAND Friction Tape you have top insulating value. That's why you find it used on high-tension lines and other places where dependable insulation is an important factor. Be sure you get the genuine . . . specify DUTCH BRAND by trade name.

Available in practical sizes and packaging for contractors and industrial users.

DUTCH BRAND

VAN CLEEF BROS. INC.

Manufacturers . . . Rubber Products . . . Est. 1910

CHICAGO 19, U. S. A.

High Insulation Strength

NEW ALLIS-CHALMERS
POTENTIAL TRANSFORMERS

★ Corona-Free Design
★ High Thermal Capacity
★ Hermetically Sealed Tank

Type SPW transformers for line-to-line or line-to-ground operations are available in all standard ratings. The transformers shown have standard insulation class ratings of 69 kv.

FOR HEAVY DUTY and accurate metering, the new Type SPW outdoor potential transformer will perform to your highest expectations. Severe insulation tests prove the SPW has excellent impulse characteristics and high 60 cycle dielectric strength. Yet it is light weight, small and compact as the table below shows.

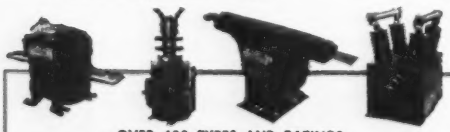
Corona-free design, applied to the vacuum dried insulation, protects the coil—another step toward longer transformer life. The tank is all-welded and hermetically sealed to protect insulation and oil from sludge formation. The unique SPW bushing construction—with oil common to both the bushing and transformer tank—has reduced transformer size and oil requirements.

Contact your nearby A-C district office for details on any of the wide range of Allis-Chalmers instrument or metering transformers. Or write Allis-Chalmers, Milwaukee 1, Wisconsin for bulletin 61B7168 listing over 400 types and ratings.

A-3271

DATA FOR TWO BUSHING TRANSFORMER

Rating	Impulse Strength kv	Output at 55°C Rise	Base Dimension	Height	Net Weight
SPW-2 24 kv	150	3½ kva	14½ x 14⅝	36½	252
SPW-3 34.5 kv	200	4 kva	15½ x 16⅝	39	310
SPW-4 46 kv	250	4 kva	19 x 19	49	615
SPW-6 69 kv	350	6 kva	25½ x 24	61	1050



OVER 400 TYPES AND RATINGS

INDOOR CURRENT transformer for low voltage metering. Type KLW 600 v.

OUTDOOR CURRENT transformer. For heavy duty metering. Type KO to 15 kv.

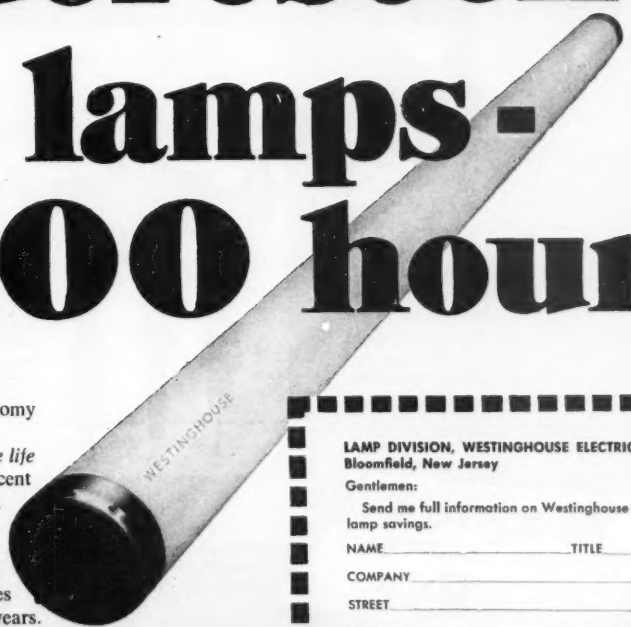
INDOOR CURRENT transformer. For heavy duty metering. Type K3E to 15 kv.

INDOOR POTENTIAL transformer. Type PD, fused or unfused, 200 va up to 14,400 volts.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

You can't beat this life! Life of Westinghouse fluorescent lamps - 7500 hours*



*You'll get lighting economy at no extra cost!

Yes, the *rated average life* of Westinghouse fluorescent lamps is 7500 hours. That means that in store installations the life is 2½ years; in one-shift factories and offices it's 3 years. No other fluorescent lamp, similarly priced, can top this life.

LAMP DIVISION, WESTINGHOUSE ELECTRIC CORP.
Bloomfield, New Jersey

Gentlemen:

Send me full information on Westinghouse fluorescent lamp savings.

NAME_____ TITLE_____

COMPANY_____

STREET_____

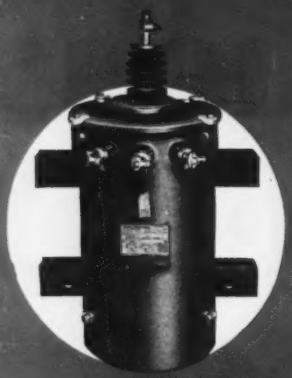
CITY_____ STATE_____

EW

Wagner RURAL LINE TRANSFORMER SERVICE

Expert Reconditioning Genuine Parts

Keep your Rural Line Transformers at top efficiency by taking advantage of the Factory Reconditioning Service and Genuine Repair Parts for "on the spot" repairs offered by Wagner Electric Corporation. Check your transformers—order the parts you need for field repairs—send those transformers that need a complete overhauling to the nearest Wagner Service Branch for speedy, expert reconditioning.

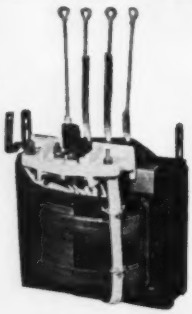


Complete Rebuilding Service

This service includes cleaning and repainting, installing all new gaskets, installing new factory-wound coils and insulation and a thorough factory inspection. A one year warranty against defective material and workmanship applies on all transformer rebuilding jobs. Just ship the transformer to us, prepaid—we will pay the return freight charges. If the transformer does not require complete rebuilding, repairs will be made on a time and material basis.

Write for Transformer Repair Schedule

All transformer repair parts are Genuine Wagner Parts —exact duplicates of those in new Wagner Transformers.

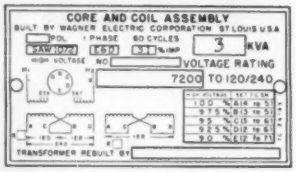


FORM W CORE AND COIL ASSEMBLIES

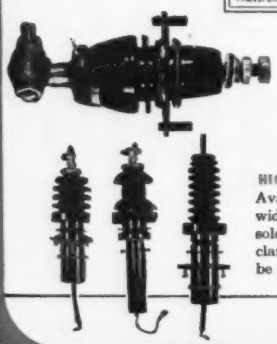
Complete with terminal board or tap changer, with leads ready to install in your tank. Form W core and coil assemblies have passed complete factory tests and, if properly installed, do not require further testing. Universal mounting brackets and locating plate furnished with the unit make installation easy.

METAL CONTAINER FOR SHIPPING CORE AND COIL ASSEMBLIES

Form W assemblies are shipped in sealed, transformer-oil filled metal containers—ready to place in the tank without additional drying. The oil in the shipping container may also be used.



NEW STAINLESS STEEL NAMEPLATES are included with core and coil assemblies.



LOW VOLTAGE BUSHING ASSEMBLY

Includes porcelain bushing, gasket, solderless connector-type terminal and clamping device.

HIGH VOLTAGE BUSHING ASSEMBLIES

Available in various types to meet a wide range of requirements. Gasket, solderless connector-type terminal and clamping device are included; fuse can be furnished when specified.

Wagner Electric Corporation EST. WE 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

NOW! LOCKE BRINGS YOU THIS SIMPLE, PRACTICAL METHOD FOR REDUCING POLE LINE HARDWARE STOCKS

Locke's RM* Handylog . . . a compact, easily-used book . . . contains complete information on all the standard Pole Line Hardware you need. It's the perfect working partner for the man who's out to SIMPLIFY his inventory of Pole Line Hardware.

Helps win battle against rising costs and material shortages—By concentrating your planning and purchasing on Locke RM* hardware items, you stock fewer items, only fast-moving items. This enables you to reduce the over-all dollar value of your inventory. You also sharply reduce storage requirements.

RM* items in good supply—All Locke RM* Hardware items are mass-produced. They're regularly in production at the factory . . . and more quickly obtainable than specials from your Locke Regional and Distributors' warehouses.

RM* (Repetitive Manufacture)— A program designed to help reduce the installed cost per kilowatt on line and station equipment.

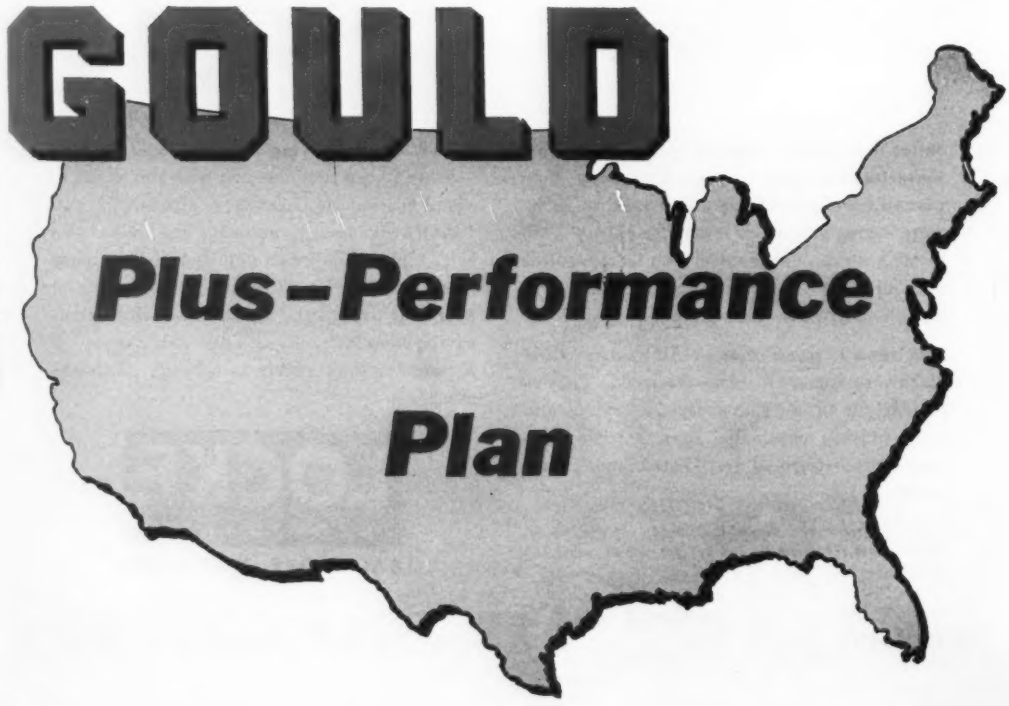
Locke RM* Handylog only guide of its kind—Only Locke provides you with this guide to simplification of hardware stocks. If you haven't got a copy, write for one today. Use it . . . place the items you find in it on your standards list. You'll be taking the only real short cut toward the big money-saving, time-saving benefits many utilities today enjoy as a result of their efforts to simplify hardware stocks.

LOCKE
INCORPORATED
BALTIMORE, MARYLAND

Before you buy stop! **See what Locke's Got!**

Here's Help

You demand more and more from your batteries as industry strains its facilities for defense. To help you get more out of these essential tools of production—to choose, use, handle and maintain your batteries without waste— Gould announces the



You Need NOW!

Battery performance can be improved as much as 50%* if these eight points are put into practice:

1. **Buy Your Batteries to Fit the Job.** Purchase of oversized or undersized batteries wastes money, materials and manpower.
2. **Install Your Batteries Correctly.** Connect them properly, ventilate adequately and handle according to printed instructions.
3. **Use Your Batteries Within Designed Capacities.** Overdischarge cuts down battery performance.
4. **Charge Your Batteries Properly.** Use recommended rates of initial, finish and float charges.
5. **Maintain Your Batteries Systematically.** Organize a preventive maintenance program.
6. **Inspect Batteries Periodically.** Tighten loose connections and replace worn cables.
7. **Test Your Batteries Regularly.** Keep a record of cell readings—know the condition of your batteries at all times.
8. **Replace When Necessary.** When you know the condition of your batteries, you can place your orders far enough ahead to insure continuous service.

GOULD'S PLUS-PERFORMANCE PLAN is designed to help you conserve and extend your essential battery power. It is a complete, integrated system of manuals, articles, specifications, bulletins, record cards and charts which give you information on every one of these eight points—explaining and illustrating how to choose, use, install, charge, maintain, inspect and test.

**From tests in the Gould Research Laboratory and performance tests in the field.*

LET THIS PLAN GO TO WORK FOR YOU...WRITE US TODAY!

Any or all of the material available under the Gould PLUS-PERFORMANCE PLAN is FREE to battery users without obligation. A request on your letterhead stating the particular problem or problems in which you are interested, will bring the appropriate literature—and booklet explaining the complete plan—by return mail. Write us, attention Field Engineering Department.

GOULD **STORAGE BATTERIES**

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

Testing and servicing are made easy by control cabinet with door hinged at bottom to form a "workbench"—and by easily removable flexitest drawout-type relay chassis.

New dollar-saving advantages have been added to the URL-8 Feeder Voltage Regulator. *Testing and servicing are now made easier, faster.*

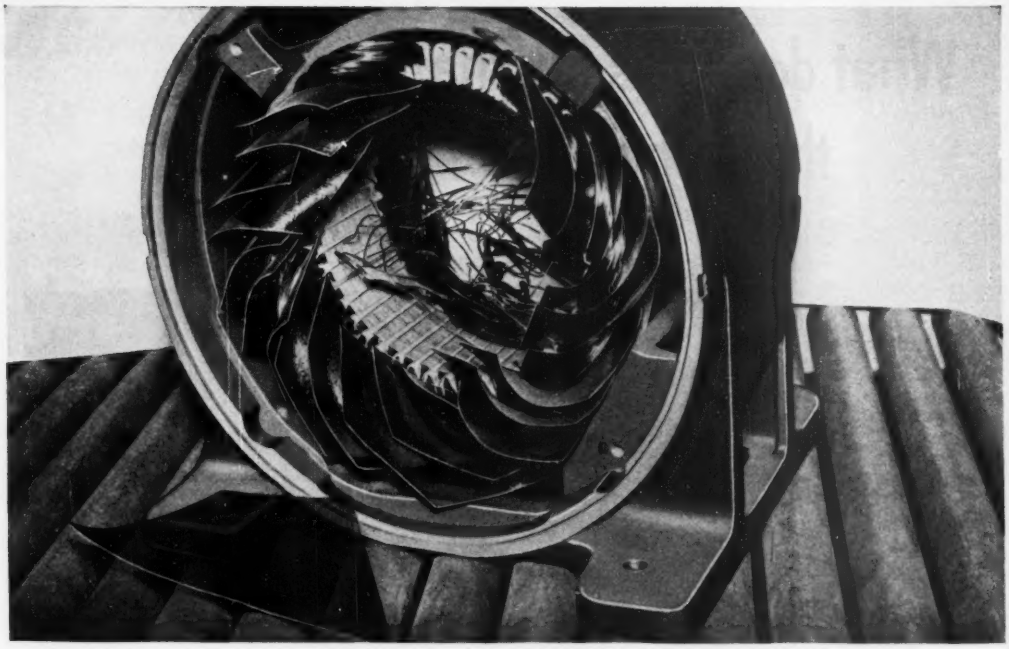
A new package control permits removal of the entire assembly as a unit—in the field—for testing or repair. Or a stand-by unit can be inserted in a matter of seconds. Mounted in a drawout-type flexitest case, it facilitates quick testing, repair or replacement. Also, the door of the control cabinet is hinged at the bottom, to form a "workbench" during inspection and servicing.

Single-pole mounting, made possible by lightweight construction, results in lower installation costs. Simple, direct drive tap changer cuts maintenance. The characteristics of the voltage-regulating relay assure close regulation. Separate resistance and reactance line drop compensation is adjustable by individual dials.

Get complete information from your nearby Westinghouse representative, or write for Catalog 47-430. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70586

YOU CAN BE SURE... IF IT'S
Westinghouse

VOLTAGE
REGULATORS



When insulation must stand 500° Heat ...look to IRVINGTON'S Class "H" Line

Whether you are winding for service at high ambient temperatures — for increased *continuous* power ratings — for greater *short-time* overload capacity . . .

Or *designing* for space-and-weight savings . . .

You will find the Class "H" insulation you want in the complete Irvington line.

Depending on service requirements, *your* high-temperature insulation job may call for Silicone Varnished Fiberglas*, in yard goods, tape or tubing forms; Silicone Glass Mica; Silicone Saturated or Silicone Coated Asbestos; Silicone Rubber Coated Fiberglas; Silastic** Tape, Teflon Coated Fiberglas.

We make them *all* — we're ready to help you use *each* to best advantage. Write for a free copy of our book — Irvington Class "H" Insulations — it contains samples. Perhaps you'd prefer to talk with one of our engineers. The coupon below is for your convenience. Send it today. No obligation.

*Owens-Corning Fiberglas Corp. **Dow Corning

Send this convenient coupon now

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☐ Please send me a free copy of "Irvington Class 'H' Insulations".

☐ I'd like to see one of your engineers. Please have him phone or write for an appointment.

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Company .....

Address ..... Phone .....

City ..... State .....

What does this International have that other trucks don't have?

L-120 International Truck (5,400 pounds GVW) with stake body —one of the 87 basic models, thousands of specialized variations in the world's most complete line of trucks.

1. It has an $11,000,000 valve-in-head engine. The new Silver Diamond valve-in-head power plant is built for truck work—and truck work only—in the world's largest exclusive truck engine plant. You get specialized truck construction that means fewer maintenance bills, longer engine life. You get specialized truck power that means lower operating costs.

2. It has "the roomiest cab on the road." Send your men to work in the most comfortable International ever built. Your men will ride in the Comfo-Vision Cab —"roomiest cab on the road." They'll get full front visibility through a one-piece, curved Sweepsight windshield. They'll enjoy controlled ventilation in any weather.

3. It has Super-steering and Super-maneuverability. A worker isn't all tired out after a drive in a new International Truck. A new International Truck is easy to maneuver in traffic, easy to park, easy to turn in the shortest practical circles. The man behind the wheel enjoys more positive steering control from a more comfortable driving position.

4. It has heavy-duty engineered stamina. You get comfort and easy handling without sacrifice of ruggedness in a light-duty International. Every International—light, medium, and heavy-duty—has heavy-duty engineered stamina in every part. This assures you the savings in operation and maintenance and the long life that have kept Internationals first in heavy-duty truck sales for 19 straight years.

Make your next buy an extra-value International. See your nearest International Truck Dealer or Branch. Get all the facts on how an extra-value International means extra profits for you.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors... Motor Trucks... Industrial Power... Refrigerators and Freezers

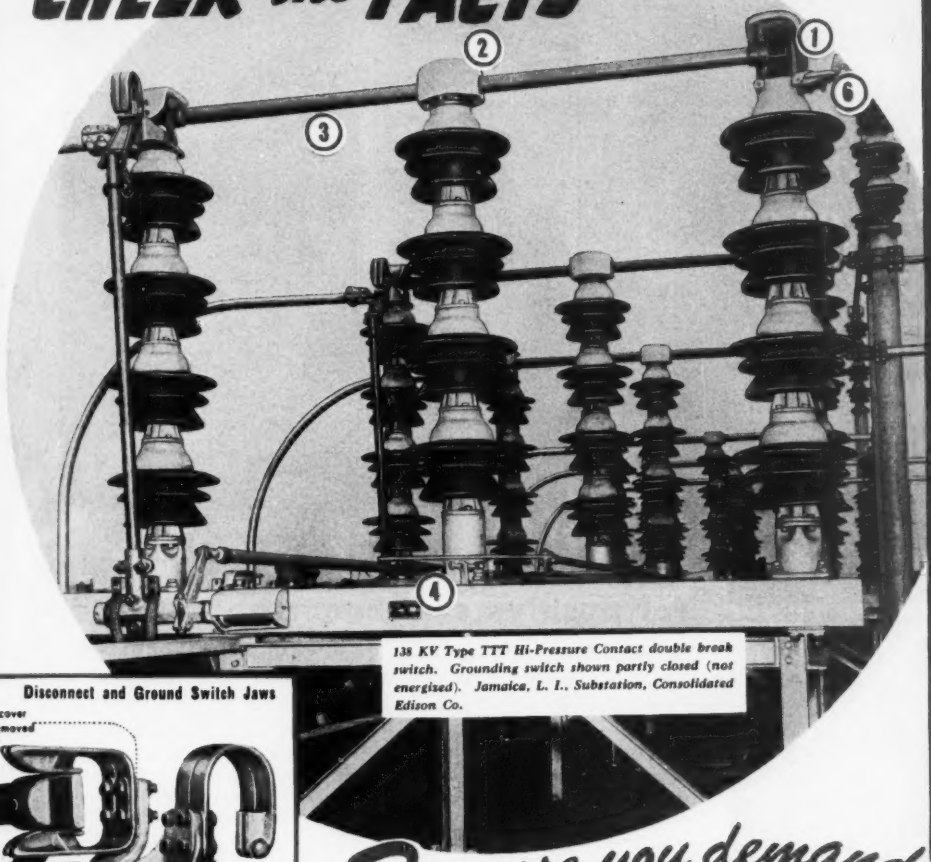
International Harvester Company • Chicago

See the new

INTERNATIONAL TRUCKS

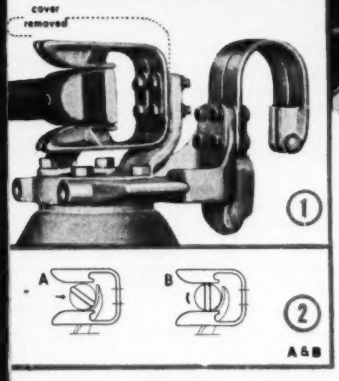
Every model heavy-duty engineered for the long haul

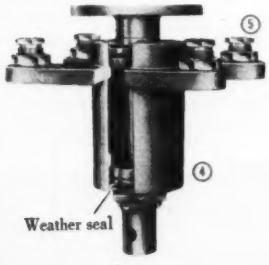
CHECK the FACTS . .



138 KV Type TTT Hi-Pressure Contact double break switch. Grounding switch shown partly closed (not energized). Jamaica, L. I., Substation, Consolidated Edison Co.

Disconnect and Ground Switch Jaws





Because you demand your switches **RUGGED**

1. **CONTACTS**—Hi-Pressure, self cleaning, beryllium jaws. Proper pressure, plus a clean contact makes a dependable electrical and mechanical contact.
2. **BLADE MECHANISM**—rotates one-piece tubular blade, AFTER blade enters jaw free of pressure—all with continuous motion.
   - A—Blade in closed position by insulator rotation.
   - B—Contact closed by blade rotation.
3. **ONE-PIECE BLADE**—High strength, high conductivity I. P. S. tubing.
4. **BEARING**—weather sealed, greaseless for smooth easy operation.
5. **LEVELING SCREWS** for alignment - also featured on all insulator stacks.
6. **TERMINAL**—four half-inch bolt, clamp type.

I-T-E R&IE

RAILWAY and INDUSTRIAL ENGINEERING CO., Greensburg, Pa.

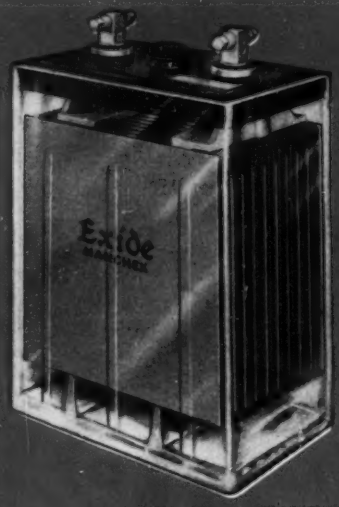
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO

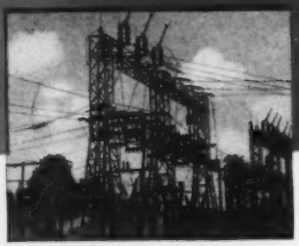
AN I-T-E SUBSIDIARY

The Check List

- CONDUCTOR SUPPORTS CLAMPS AND FITTING
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

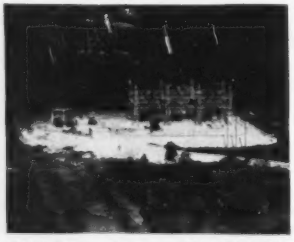
IN MODERN SWITCHING STATIONS THROUGHOUT THE COUNTRY





South Carolina Electric & Gas Company

Union Electric Company of Missouri



Public Service Company of New Hampshire

Exide-Manchex BATTERIES
for positive switchgear operation

In Exide-Manchex Batteries you get ALL the qualities that add up to dependable performance, long battery life, maximum economy. They give you:

POSITIVE OPERATION. Energy is delivered at high or low rates, providing dependable performance at ample voltage with no switching failures.

INSTANTANEOUS POWER, capable of discharging at high rates for switchgear operation and providing adequate reserve power for the dependable performance of all other control circuits and also emergency lighting.

LOW OPERATING COST. Extremely low internal resistance. Power required to keep battery floated and fully charged ranges between 0.25% and 1.0% of the 8 hour discharge rate in amperes.

LOW MAINTENANCE AND REPAIR COSTS. Water required about twice a year. No change of chemical solution needed during life of battery. Repair costs negligible.

UNUSUALLY LONG LIFE, due to sturdy construction; the famous manchester positive plate; a combination of specially treated wood and plastic separators; and many other exclusive features.

GREATER CAPACITY in a given amount of space, avoids overcrowding of equipment.

These and other features combine to make Exide-Manchex the best buy for all central and substation battery services.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

"Exide" and "Manchex" *Reg. Trade-marks U. S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951

You get all these trouble-free construction features in EXIDE-MANCHEX BATTERIES

The exclusive, long-life manchester positive plate.

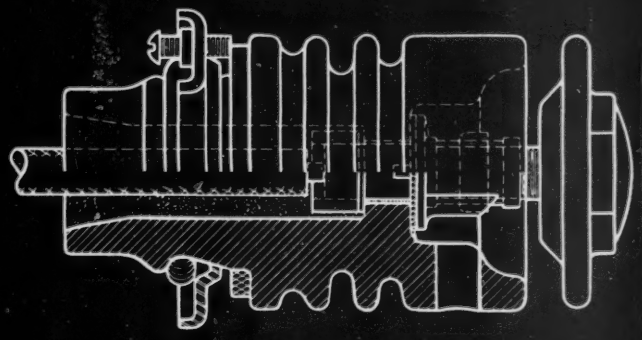
Latest development in molded glass jars for compact installation.

Heavy terminal posts with copper inserts for extra conductivity for instant high discharge.

Slotted plastic separators, impervious to chemical and electrical reaction.

Plastic spacers for plate alignment.

IT'S A FACT:
KUHLMAN QUICK-GRIP . . . MOST COPIED TRANSFORMER BUSHING . . . BECAUSE IT'S SAFER!



We're proud of the fact that the Kuhlman Quick-Grip bushing terminal, because of its outstanding safety and convenience, has become the most copied transformer bushing in Americal Not only have its features been adopted by other transformer manufacturers, but it has also been specified as the preferred design by utility engineers.

Why? Because the heavy insulating knob by which connections are made prevents a lineman from making accidental contact with live parts. And, because the wire is connected to the terminal through the side, he does not have to grip over the lead as is the case where the wire enters a rotating chuck type terminal. Still an exclusive feature with Kuhlman Quick-Grip bushings: there is only one entry point for the line lead, which eliminates the possibility of the sharp point of the lead protruding on the opposite side of the bushing to provide a definite hazard to the lineman or his clothing.

Kuhlman Quick-Grips are easy to operate, too, since no tools are needed in making the line connection. The clamp accommodates the full range of wire sizes prescribed by EEI-NEMA Standards. All mounting hardware is inside the tank, protected from the corrosive effect of the atmosphere.

The Kuhlman Quick-Grip bushing is available on all Kuhlman transformers 5 KV and below where sidewall high voltage bushings are standard construction. Write today for full details.

Kuhlman ELECTRIC COMPANY, BAY CITY, MICHIGAN

EXPORT REPRESENTATIVES: *International Standard Electric Corporation,* 67 Broad Street, New York 4, N. Y. Cable Address, Microphone, N. Y.

A complete transformer line for ALL your needs. Write for easy Kuhlman bulletins on Distribution, Power, Dry Type, Street Lighting and Specialty units.

KUHLMAN ELECTRIC

103

ALLIS-CHALMERS SWITCHGEAR

Helps Pratt & Flying Conditions

Unique Distribution System with Allis-Chalmers Switchgear and Control Board Protects and Controls Equipment in New Willgoos Jet Research Laboratory

IF YOU COULD STEP behind the walls of Pratt & Whitney's huge windowless jet laboratory — largest of its kind in the world — you'd see equipment designed to simulate flying conditions at 45,000 feet . . . ram blowers, exhausters, motors. Protecting valuable electrical equipment is Allis-Chalmers 500 mva metal-clad switchgear. An Allis-Chalmers duplex board remotely controls the equipment.

Allis-Chalmers engineers assisted materially in developing the unique scheme for control of the 24,000 hp dynamometer. Four shipboard type generators supply power to the dynamometer at frequencies which can be varied between 15 and 93.3 cps. Each generator can be connected to a common motor bus through the air blast circuit breakers. The synchronous motor of the dynamometer is connected to the bus through disconnecting and reversing switches.

To utilize generator capacity when the dynamometer is not in use, a constant frequency bus has been provided in the switchgear lineup. Additional switchgear units connect each generator to this bus for utilizing the generating capacity at 60 cycles.

Does your plant rely on standard Allis-Chalmers metal-clad switchgear for dependable equipment protection? If not, it will pay you to investigate.

Allis-Chalmers switchgear is completely assembled, ready to operate when delivered and installed. Standard units can be added as your load expands.

Allis-Chalmers switchgear is all steel enclosed, completely insulated and safety engineered. Furnished with air blast, *Ruptair* or oil circuit breakers.

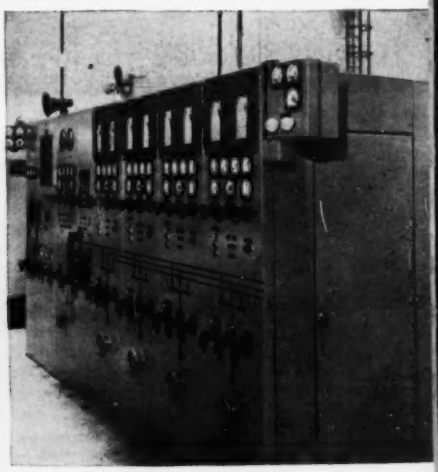
For more information on Allis-Chalmers switchgear contact your local Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

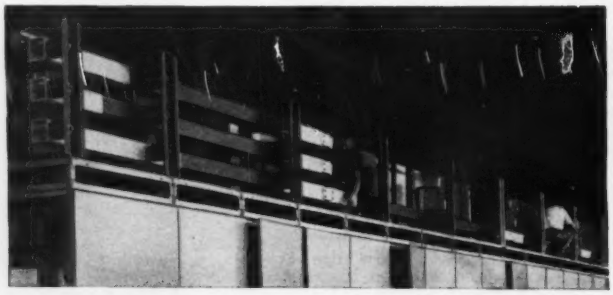
A-2306

The duplex tunnel-type metal enclosed control board (right) remotely controls the motor, the generators and other electrical equipment. Positive interlocking, instrumentation and recording assures the operator of accurate control of circuit switching.

This 4000 ampere 93.3 cycle metal-enclosed bus duct (below) connects the dynamometer to the disconnect and reversing switches. Its special design keeps reactance to a minimum.

Ruptair is an Allis-Chalmers trademark.



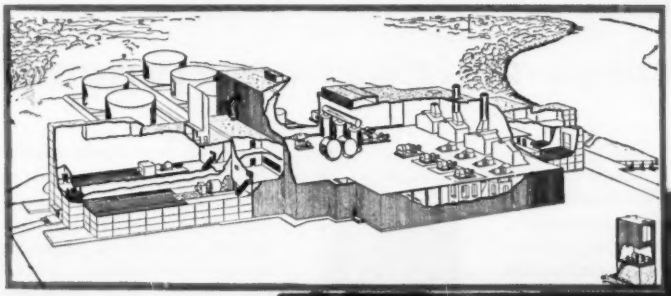


ALLIS-CHALMERS

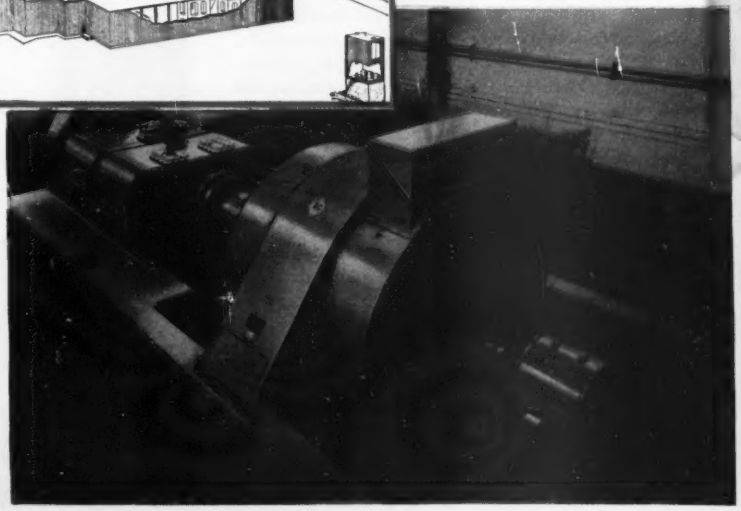
A-C ALLIS-CHALMERS

First in the U. S. with Metal-Clad Switchgear

Whitney Simulate at 45,000 Feet

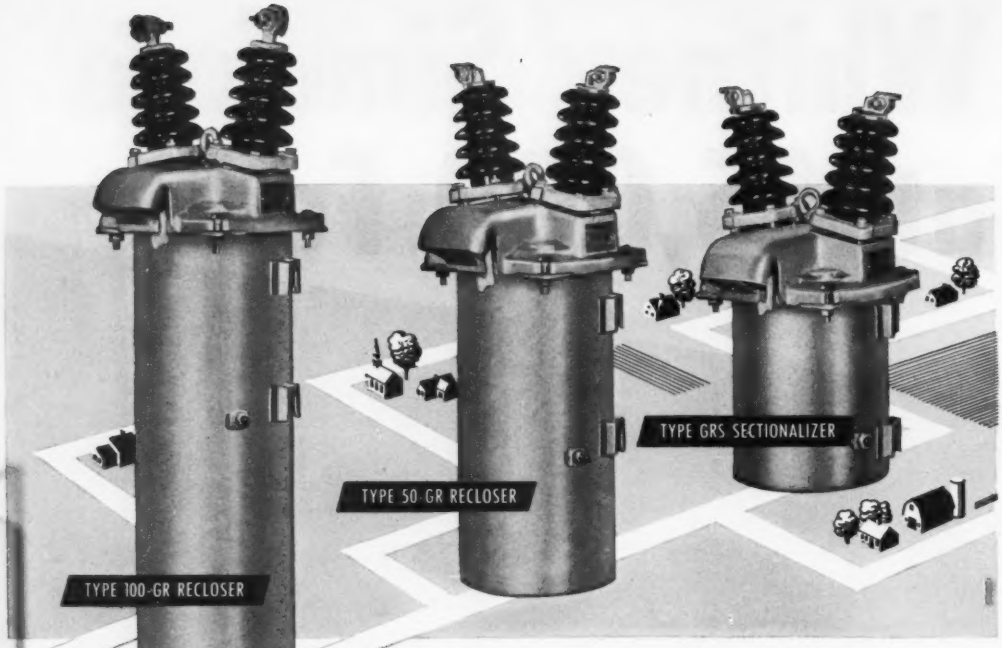


Allis-Chalmers switchgear with 500 mva air blast circuit breakers is used for control and dynamic braking of the 24,000 hp synchronous motor and for protection of generating equipment. Air blast circuit breakers are consistent performers under varying operating conditions. Both the operating mechanism and arc interrupting devices are air operated.



Willgoos laboratory (above) testing ground of aircraft engines of the future, is the largest privately owned building of its kind. Turbine engine burner components are tested in cells to the extreme right. Air speeds up to 550 mph and air temperatures down to −70° F are duplicated in the laboratory.

Driving power for turbine-compressor test cell comes from this Allis-Chalmers cradle-mounted dynamometer (right) using a 24,000 hp, 3000 volt, 3 phase, AK synchronous motor and torque measuring equipment. Dynamometer mounting permits measurements of gear output torque within an accuracy of one-half of one percent.



YOU NEED ALL 3

...for long-range distribution economy!

Calculate your probable fuse replacement costs over the next fifteen years—the period in which forecasts say loads will triple. We'll guess your answer suggests need for a less costly protective system. Ideally, it would be a system which eliminated fuse replacement costs... which stayed in perfect co-ordination *permanently*... which simplified the job of system sectionalizing on rural and suburban lines.

The units pictured above are components of a system which *does fulfill these requirements!* It's a completely mechanical system which employs Type 100-GR reclosers or reclosing breakers at the substation, and Type 50-GR reclosers co-ordinated with sectionalizers on the line. For forward thinking system planners it represents a *sure* way to gain this important objective:

THE HIGHEST DEGREE OF SERVICE CONTINUITY AT THE LOWEST LONG-TERM COST!

The mechanical protective system is just one of those analyzed in Booklet B-4700, which covers advantages, limitations and cost considerations of all types of protective schemes for rural and suburban lines. For your copy of this practical guide to better protection planning, write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

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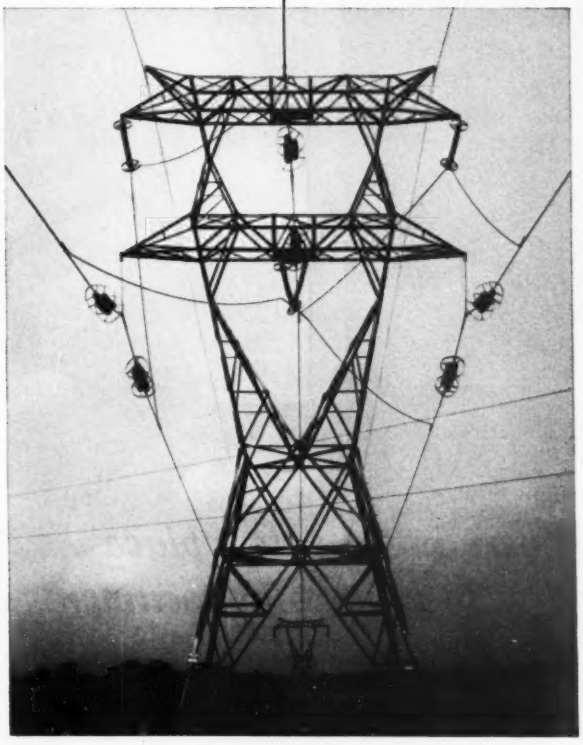

With our Tower Department, "Right down the line" means—be *right* every step of the way from specifications, design and fabrication, to hot-dip galvanizing. It may take many years for such thoroughness to prove its value. But the longer it takes the less Blaw-Knox Towers cost you in the end . . . and no more at first!

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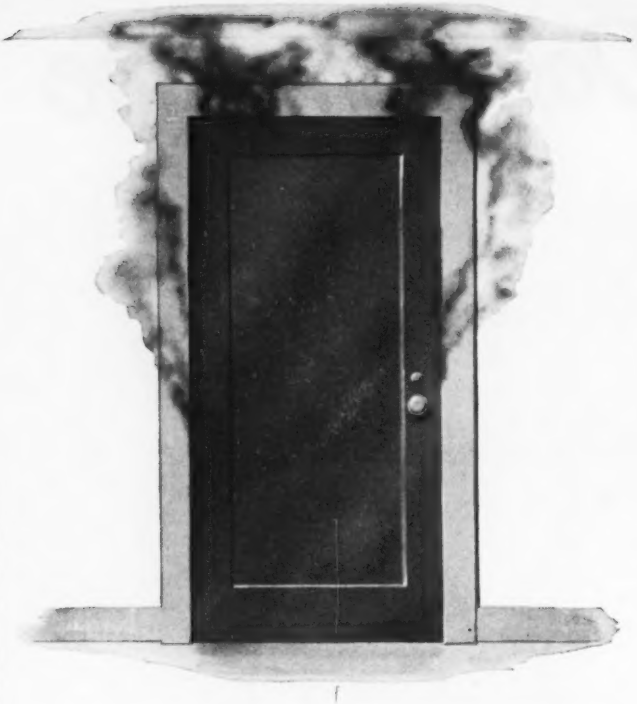

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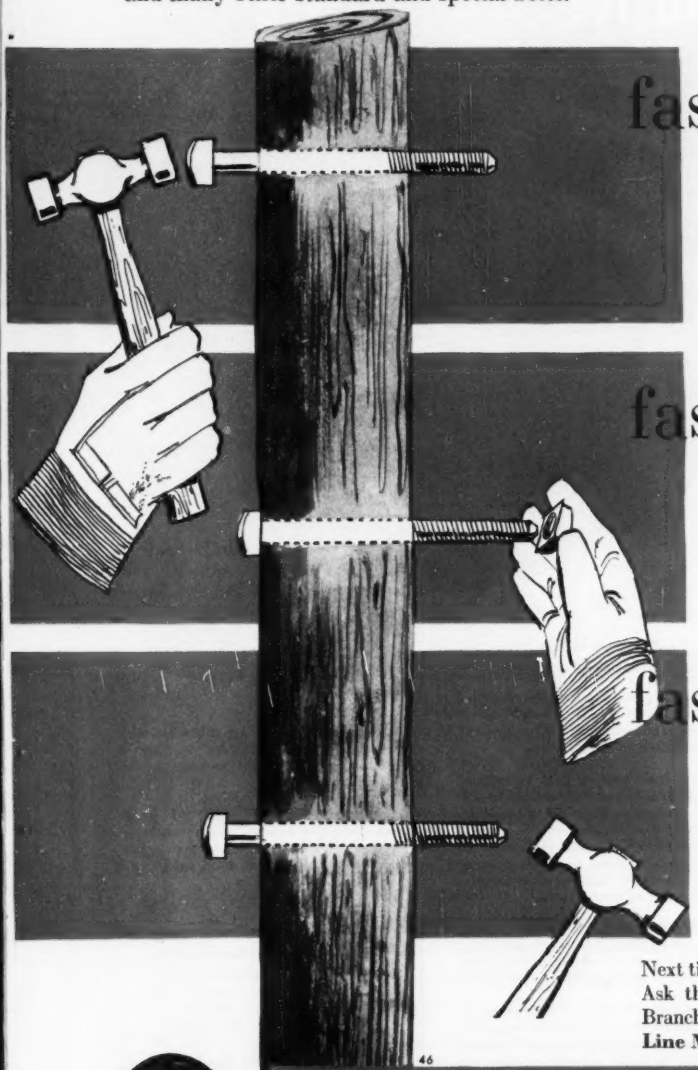
DESIGNED, BUILT, SERVICED — *"Just a little better"*

You can speed up construction with

L-M Buffer Point Bolts

Buffer Points are standard on all L-M Bolts 6" and longer, including carriage bolts, machine bolts and double arming machine bolts, eye, double arming, and thimble eye bolts and many other standard and special bolts.



faster driving

tapered buffer point guides the bolt through the hole, with less friction

faster threading

buffer point guides the nut right onto the thread—no fumbling, no lost time

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hammering the point removes the bolt quickly—can't hurt the thread

Next time you order bolts, get L-M Buffer Point Bolts. Ask the L-M Field Engineer, call the nearest L-M Branch, or write, wire, or phone **Hardware Division, Line Material Company, Milwaukee 1, Wisconsin.**

46

LINE MATERIAL Pole Line Hardware

Complete Coordinated Equipment for All Distribution Requirements

You said it...

...We did it!

We designed ELEMEX capacitors to give you what you need!

Utility men with ten to fifteen years of field experience knew pretty well what they needed and wanted in capacitors. Just about ten years ago L-M began its capacitor design and in 1944 began producing capacitors incorporating some of these user-ideas.

ELEMEX capacitors have an excellent service record. Rate of failure has been low; performance has been consistently good—so good, in fact, that we have never completely caught up with the demand for more and more ELEMEX capacitors.

Here are some of the things you said you wanted in a capacitor, and what L-M has done about it.

1. Long life: L-M's low unit insulation stress, individual evacuation, capillary impregnation and many in-process tests have assured a very long life and freedom from trouble. We're proud of our performance record! Over 99.44% of all ELEMEX capacitors manufactured over a 7-year period are still in operation. That is a failure rate of less than 1/10% per year!

2. Strong solder-sealed bushings: L-M developed a new, stronger method of solder-sealing. L-M tests 100% of its bushings and seals. Actually, it takes 1900 pounds to force an L-M bushing out of the cover! Also we've got higher creepage distance, unbreakable terminal caps.

3. Pure aluminum electrodes: Not just tinned copper—but pure aluminum.

4. Simple, easy installation: We designed them with uniform terminal height above mounting flanges, gave you "Paragroove" connectors which simplify wiring.

5. Low-cost maintenance: L-M introduced stainless steel tanks and will *continue* to produce them as long as Type 304 is available. (Incidentally, this forced down the price of mild steel units, which saved you money on *both* types!) L-M mild steel tanks have *three* coats of enamel, each *baked* separately, not just one or two spray coats.

6. Streamlined tanks: Large-radius rounded corners make ELEMEX tanks smooth, give improved appearance, and extend paint life. Sharply sheared edges always corrode first.

7. Convenient, sensible packaging: In sturdy, wood reinforced sealed cartons. Full identification printed on sides and ends of carton, with the serial number repeated on the top of the carton for the convenience of the storekeeper. Painted surfaces subject to abrasion in shipment are protected with wax paper. Only L-M packs its 2 and 4 unit hangers in individual cartons to simplify handling for you.

8. Simple low-cost switching: L-M's new Voltage-Sensitive Control gives you accurate, dependable switching at a cost low enough to permit its use even with small capacitor banks.

Want to cut line losses? Reduce wattless current on your lines? Get capacitors that stay on the job? Ask the L-M Field Engineer for full information on ELEMEX capacitors; or write Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL... Capacitors

Complete Coordinated Equipment for Distribution Today

for faster underground installations

New L-M Spacers

New L-M Base Spacer:

assures rigid foundation, desired gradient. Interlocking ends; wide flat base—the spacer will not tip over during or after installation. All L-M spacers come in standardized cartons to save stockroom handling and space. Available from stock, in six standard sizes.

New L-M Intermediate Spacer:

made of asphalt and asbestos fibre, highly resistant to acids and alkalis, fire resistant, Underwriters' listed. Withstands vertical flat crushing test of over 1200 pounds. Grooved ends lock together with the next spacer; centers notched for sawing.

New L-M Bend Spacer Bar:

a duct-installation leveller, used horizontally or vertically for accurate alignment of conduit around bends. Saves hours of work in lining up. Offers a tremendous saving in installation labor costs. L-M exclusive. 20′ long, 1½″ square, easily sawed to length.

New L-M Multi-Use Bend Sections and Angle Couplings:

use in any combination to make all kinds of special bends and crossovers. Male and female tapers offset 2½°, giving 5° bend in each section. Smooth inside, watertight tap-tite joints.

The L-M System makes Fibre Conduit *so easy to use*

New L-M Fibre Conduit Vise

An easy, safe way to hold fibre conduit for sawing or tapering. For mounting on truck or bench, or with detachable tripod for use in the field, on the job.

With L-M Fibre Conduit and L-M equipment and tools, L-M's system speeds up underground installations, makes better jobs.

L-M Fibre Conduit is strong, light, tough; yet it's easy to taper and cut to length. L-M base spacers, intermediate spacers, and bend spacers assure a firm foundation and a rigid structure that won't settle or shift.

L-M tools save hours of time in the shop and on the job. Better get the low-down on this high-class, time-saving equipment.

GET THIS FREE HANDBOOK! Pocket-size manual covers recommended underground construction practices; contains valuable reference tables. Ask the L-M Field Engineer for a copy, also for new Fibre Conduit folder; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

New L-M Tapering Tool

Cuts a precise 2° taper on the end of conduit to assure tight, snug joints. Light; easy to use; saves time; cuts costs by salvaging cut ends and short lengths quickly.

36

LINE MATERIAL... Fibre Conduit

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Everything you need for
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Complete equipment from one source!
Ask your utility company lighting engineer,
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for information about L-M equipment.
Or write for information and bulletins.
Line Material Company, Milwaukee 1, Wisconsin
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LM
LINE MATERIAL
Street Lighting

NATVAR IN BRAZIL

Stators, insulated with Natvar slot cell insulation and varnished cambric tapes, on racks ready for infra-red baking operation.

A corner of the Test Department at Arno, S.A., of Sao Paulo.

This exploded view shows the simple yet rugged construction typical of Arno motors. The motor shown is 1½ hp., three-phase, drip-proof.

Arno, S.A. of Sao Paulo, Brazil, the leading manufacturer of electrical equipment in Brazil, produces most of the motors, and associated power equipment used in South America's largest country.

Like the manufacturers of similar products in North America, Arno realizes the importance of quality electrical insulating materials for unfailing service in the field. It is for this reason they have selected Natvar products for their insulation requirements. Arno motors depend upon Natvar slot cell insulation, varnished cambric tapes.

All Natvar electrical insulating materials are recognized for their high standards of quality and uniformity throughout the world.

• Natvar flexible insulating materials are distributed in Brazil by Casa Rand Comercio E Industria S.A.

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- Lacquered tubings and sleevings
- Extruded vinyl tubing and tape
- Extruded vinyl identification markers

Ask for Catalog No. 21

"There is no bigger job of industrial journalism

Top industrial editing does not come cheap. The editorial budget of an outstanding business publication, such as Electrical World, is larger than the total incomes of some of its competitors.

The spending of such a budget must be carefully planned to cover every phase of the industry as well as every state in the union.

On Electrical World we have 12 full-time traveling editors. They divide up the U.S. Each is responsible for knowing everything electrically important and newsworthy that happens in every utility and industrial plant in his specific territory.

In addition, there are five headquarters editors responsible for assembling and interpreting reports sent in from 30 Electrical World correspondents, the six McGraw-Hill Domestic News Bureaus, and McGraw-Hill World News. *And besides this, 345 industry leaders, who live in 112 cities throughout the U.S. and four foreign countries, wrote articles for Electrical World last year.* Can you name an industry served more completely?

No smaller effort could cover the great-growth industry. To satisfy America's demand for electric power, this industry will triple in size in the next 15 years. This year and next, and the year after, it will spend more money on capital goods than any other industry.

Yes, this is one of the biggest jobs of industrial reporting in America, but, done well, it means the interest and confidence of readers in the highest degree—the most valuable things you buy in an advertising medium.

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JOURNAL OF THE GREAT GROWTH INDUSTRY FOR 77 YEARS

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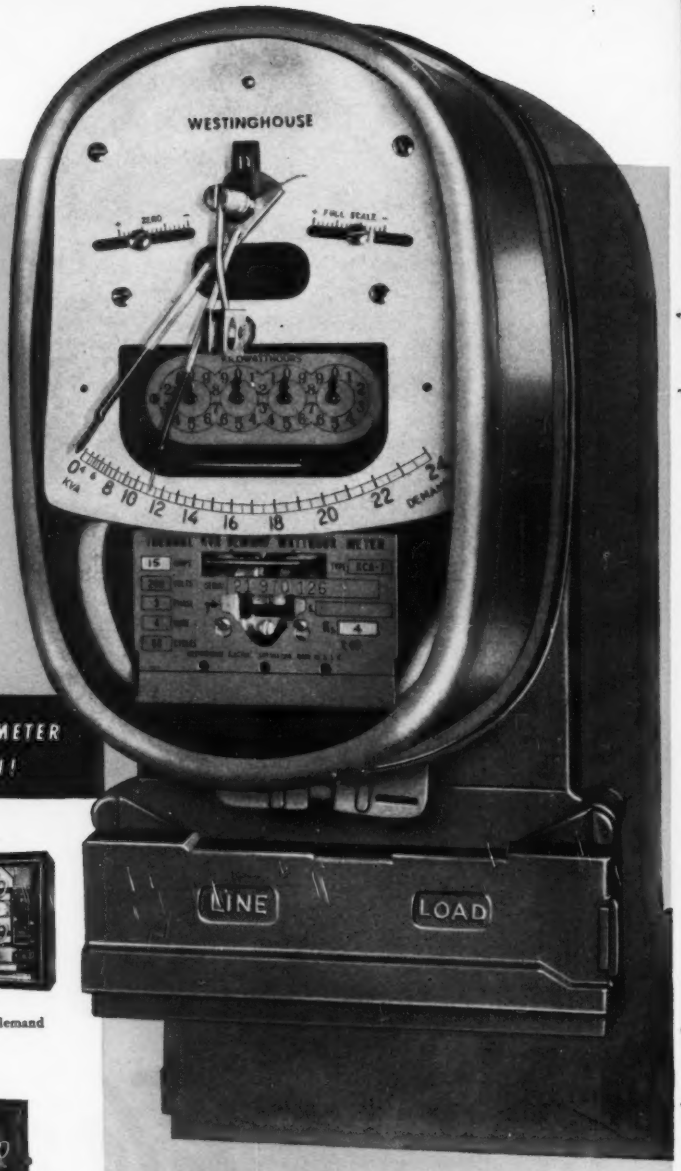
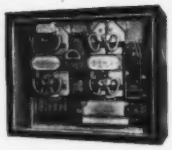
ABC • ABP

The new KCA combination watthour and thermal kva demand meter is available in five types for a variety of circuit applications. It's the first polyphase combination watthour and thermal kva demand meter on the market.



THERE'S A WESTINGHOUSE METER FOR EVERY APPLICATION!

Polyphase thermal kva demand meters.



Recording kva demand meters.

Totalizing kva recording demand meters.

Kva indicating demand meters.

NEW Combination Polyphase Thermal kva Demand Meter

Cuts KVA Metering Costs!

Here's another Westinghouse "first" that answers a metering problem by helping you to attain low-cost kva demand metering. It's the new KCA Meter which combines a simple, practical method of measuring kva demand, with low maintenance cost. And it joins a large family of cost-savers because only Westinghouse offers you . . .

A complete line of kva demand equipment . . . one that meets all of your present needs and anticipates many of your future requirements!

Illustrated here are some representative examples of the diversified equipment Westinghouse offers for this important application. This is the equipment you need for accurate kva demand measurement of any power loads.

In the complete line of Westinghouse metering equipment you'll spot many opportunities for savings. So whatever your metering needs, call on Westinghouse.

For complete information on the new KCA meter write for Catalog Section 42-340. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40395

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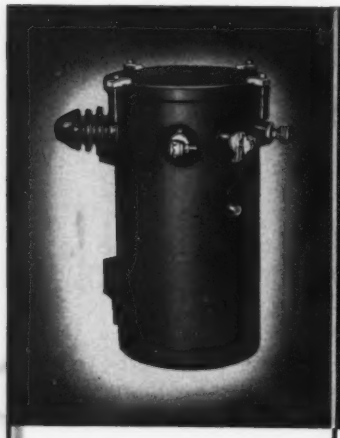
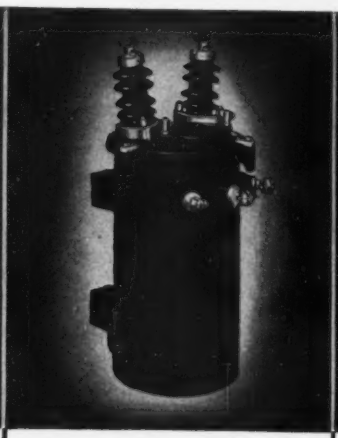
Westinghouse
METERS

MOLONEY DISTRIBUTION TRANSFORMERS
...for *DEPENDABILITY and PERFORMANCE*



CONVENTIONAL TYPE LL

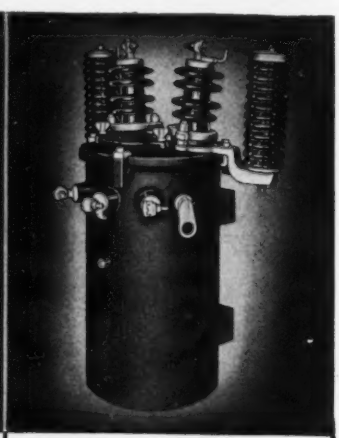
The Type LL Transformer is provided with sidewall-mounted high voltage and low voltage bushings for use on system voltages of 5000 volts or below. These transformers are manufactured in standard Kva ratings from 3 to 100 Kva. Porcelain protective caps are regularly supplied on the high voltage terminals of Type LL Transformers to protect the lineman from accidental contact with the live terminals.



CONVENTIONAL TYPE CL-2

The Type CL-2 Transformer is provided with two cover-mounted high voltage bushings. These transformers are standard in sizes 167 to 500 Kva in all voltages and in sizes 3 to 500 Kva in voltages above 5000 volts.

Transformers with a single cover-mounted high voltage bushing, designated as Type CL-1, are designed for use on grounded neutral systems. One end of the high voltage winding on this type transformer is grounded to the tank internally.



COMPLETELY SELF-PROTECTED

Completely Self-Protected Transformers are equipped with lightning arresters, internal protective links, tank grounding gaps, and secondary circuit breakers. These transformers are available in standard ratings up to 100 Kva and voltages up to 15000 volts. High voltage bushings are sidewall-mounted for voltages of 5000 volts and below and are cover-mounted for voltages above 5000 volts.

The Moloney Electric Company has a transformer to meet the requirements of any distribution system. Recognition of the fact that continuity of service is a "must" on these systems has always been a guide to Moloney engineers in the design of distribution transformers.

Conventional Distribution Transformers are available for those customers who prefer to supply their own protective equipment. For those who prefer integrally mounted protective equipment, there is available a complete line of CSP (Completely Self-Protected) Transformers. Superior electrical performance is assured in all Moloney transformers as a result of liberal design and quality control.

MED1-11

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Editorials

The Conscience of the Industry

"Each of our industry groups is performing an outstanding service, but without lines of communication between them fires can start and grow to conflagration size before we get busy and call out the fire department. . . . It isn't possible for us to act with effectiveness and strength when we must wait for the formal concurrence of four separate industry groups acting through their directorates. Under such conditions, it is impossible to realize the combined power of a united industry front."

Such were the appealing words of Pres. P. H. Powers of the West Penn Power Co in his address before the Southeastern Electric Exchange calling for coordinated efforts on the part of the industry's major associations. Because consolidation of associations is prevented by various legal and technical difficulties, Powers suggested that each company "join up with the four important existing industry groups."

The Edison Electric Institute (EEI) is now supported by approximately 80% of the companies. Here activities are limited to those of a trade association.

The Electric Companies' Advertising Program (ECAP) is supported by about 60% of the industry. Its aims are to improve the public attitude toward the electric companies and discourage government encroachment.

The National Association of Electric Companies (NAEC) has two-thirds of the industry in its membership. It was organized to bring facts before the members and committees of Congress.

The Public Information Program (PIP) has 69 member companies. It was organized to disseminate information to employees, stockholders, customers, and the public and to make allies of other industries facing the same broad problem of government encroachment.

One hundred per cent membership in each of the big four industry groups would, without doubt, assist materially in the coordination of activities. But this is not enough.

An unofficial coordinating committee made up of the top executives of the four groups mentioned above along with the Association of Edison Illuminating Committees has been set up. The members of this group should be officially selected to speak for the group they represent. Then the second step of industry coordination would be complete. Related activities of Reddy Kilowatt and other industry groups should be handled appropriately. The selection of one man from the coordinating committee as chairman who as an individual could speak for the industry would perhaps be the next step.

Through these steps the agencies can work toward the ultimate goal of strong leadership with a small coordinating group providing the conscience of the industry.

Let Tacoma Build Its Cowlitz Project

Prompt action by Interior Secretary Oscar Chapman to recommend Federal Power Commission approval of the proposed 460,000-kw Cowlitz hydroelectric project of the City of Tacoma can accomplish two very worth while objectives. First will be addition of some badly needed capacity in the sorely power-deficient Pacific Northwest long before large federal projects can be put in operation. Second will be construction of the carefully engineered $7-million fish handling facilities adaptable to continued research and development which can provide invaluable experience and information on the fisheries problems, long a point of conflict between fish and power interests.

The Secretary has recognized the need for prompt construction in the Northwest of nearly 1 million kw of new non-federal generating capacity which can be put on the line in the next two to three years. Approval of Cowlitz, a substantial component of that million kw, is desirable since new defense loads have been assigned to the area on the basis of median rather than critical water conditions. This approval would be desirable even if there were reason to believe there might be serious damage to fish resources on the river.

To the contrary, downstream migratory facilities developed by engineers and biologists retained by Tacoma, subject to modification and improvement, should solve the fish problem on the basis of any reasonable appraisal. Although satisfied after extensive investigations and tests that the planned facilities will solve the problem, Tacoma has taken the reasonable position that cooperative experimental work can and should be carried on even after construction is completed and that changes should be made from time to time if the facts warrant.

The fundamental conflict between fish and power interests where high-head dams are involved will never be resolved until someone makes a constructive approach to the problem. The Cowlitz project is a made-to-order opportunity to gain invaluable experience from a well-engineered approach to the problem in a working laboratory.

Why Not a PPD?

(Reprinted from "Colfax (Wash.) Gazette-Commoner")

This PUD-WWP affair encourages the editor to reveal, at last, his long-cherished and spectacular plan for the formation of a state-wide PPD, with headquarters in Whitman county.

PPD? Haven't you guessed?

That's right, it stands for Public Pea District and would furnish us with the means of forcing—,er we mean, passing on the benefits—of the Palouse country dry pea to the public.

Private enterprise has failed miserably in putting split pea soup on every housewife's table—it has failed to bring cheap split pea soup to the home of the lumberjack, the undertaker, the haberdasher, the raconteur, the connisseur, etc. It's failed to fully develop the pea resources of the Palouse country. It's high time the people took over, since peas belong to the people!

We can start by forming a Whitman county PPD to provide cheap peas for every home, and we know that the southern part of Spokane county and Latah county, Idaho will immediately form their own PPD's.

Then just as soon as the legislature passes a law, and the governor signs it (on promise that we won't take over more than one private pea company) we can begin dickering with American Pea and Legume Co., a holding company, to buy their common stock in the Washington Withered Pea Co., and take over the pea business in all of Western Washington. Of course, we can pay them twice what it's worth and slip a little commission to P. Markuter, the broker.

Once the deal is put through, the Whitman county PPD will have the rest of the state where it wants them—we'll furnish 'em peas and pea soup until it runs out of their ears—we'll teach the public the great benefits of pea-eating and pass on the savings of a PPD to them. We'll even agree to pay some "in lieu" of taxes to make up for the taxes the private pea companies will no longer be paying.

Long live the PPD! (Even *sounds* better than PU-D, doesn't it!)

Electrical Engineers for Co-ops

Quite a lot of space in "Electrical World" has been devoted to the problem of attracting electrical engineers into the electric utilities. In addition to the problem of availability of graduates we have that of the attractiveness of employment. Security has lost its lure. It's pay and opportunity for advancement that draw engineers.

The co-ops are in a very disadvantageous position in this respect. They must begin to recruit electrical engineers to handle day-to-day technical problems. The competition is going to be tough. The best suggestion we can think of is the establishment of a scholarship. Each co-op could set up a scholarship for a local boy in a good technical school. It could require repayment of the loan if the recipient failed to return to the co-op.

Such a plan would not only aid the co-ops but the industry in general.

Saving the Technically Trained

The problem of maintaining an adequate system of deferment for technical students and graduates is now receiving substantial consideration. No little credit for this is due to the work of the Engineering Manpower Commission of Engineers' Joint Council. It should be a source of great satisfaction to the engineering profession to know their representatives in the EJC are taking appropriate action in this and other matters as the need arises.

The Electrical Week

INDUSTRY MOBILIZATION—M-50 has been amended to give electric utilities until June 1 to use materials on hand without Depa approval (p 80) . . . Interior's seven defense advisory councils will meet in Washington May 9 (p 80) . . . C. R. Beardsley, retired from Consolidated Edison Co of New York, is now chief of the power requirements branch of Depa's Power Supply Division (p 80) . . . Both House and Senate have voted to repeal the 2¢ import duty on copper but still have a few differences to iron out (p 80) . . . Steel forgings, tungsten, and cobalt are in scarce supply, stories on Page 80. Industry M-Orders are listed on Page 80.

WASHINGTON—Pacific Power & Light Co receives 50-year license from FPC to construct Yale hydroelectric development on Lewis River in Washington State (p 85) . . . Richard D. Searles, Arizona rancher, is sworn in as Undersecretary of Interior (p 86) . . . Vepco petitions FPC for second dam on Roanoke River in North Carolina as first meets Interior opposition (p 87).

ELSEWHERE—Six private utility leaders explain the industry's power policy to the farmer (p 81) . . . Construction begins on North Dakota loop of Reclamation's Missouri Basin transmission grid (p 83) . . . U. S. Chamber of Commerce water policy recommendations differ greatly from report of President's Water Resources Policy Commission (p 84) . . . Engineering and Operation Section of Northwest Electric Light and Power Association is told elimination of nonessential spending by Reclamation could save taxpayers $173 million (p 85) . . . Consumer's Price Index gets an overhauling as an indicator of price movement in a controlled economy (p 86) . . . Southern California Edison Co becomes fifth utility to install millionth meter (p 87).

• • •

The bill to make possible the construction of an electrically driven conveyor belt line from Lake Erie to the Ohio River has been bottled up by the Rules Committee of the Ohio Senate. It is doubtful whether the House will act this session on an identical bill.

Six TVA generating plants have had a total of 1,853,853 man-hours worked without a chargeable injury. Hiwassee Dam leads with 10 years, 10 months without an accident.

A power plant was involved recently in a maritime salvage case. The plant is the Sackett's Harbor municipal plant of Anchorage, Alaska. This originally was the stern section of a tanker of the same name. On a trip in the Pacific the tanker broke into two sections. The salvage suit was brought by some members of the crew who aided in getting the stern section to Alaska. A small award was made the men.

Steel and nickel cutbacks are tough on the stove industry, but an order limiting the number of units to be manufactured would be worse, the industry's advisory committee reported to NPA. The industry would rather have allocations of basic materials than a limitation order, NPA was told.

Volume VII of "Federal Power Commission Reports," containing opinions and decisions for the calendar year 1948, has just been issued by FPC. The 1,212-page book sells for $4.25 and may be ordered from FPC's publication section.

Notes From The News

When a GI in Korea dives into a foxhole to duck a Red shell he may owe his life to a machine used by utilities for years. The army has converted the standard post-hole digger into a foxhole digger—digs an eight-foot hole in less than two minutes . . . Now even employee relations has switched to TV. Last month 12,000 Detroit Edison Co employees in southeast Michigan attended an "all company meeting" via video. The "meeting" broadcast featured a film report on company activities and plans . . . Propeller-driven air turbines vs conventional windmills as sources of power is the subject of a study being conducted by the Organization for European Economic Cooperation. OEEC estimates Britain and France can produce as much power by wind utilization as by all other means combined . . . On the other side of the curtain, Prague residents have been asked to save electricity for the Czech five-year plan by heating no rooms with it in the daytime and using no appliances in the evening . . . And up along the Norwegian west coast a prolonged drought has brought an acute shortage of hydroelectric power. In many cities, power is on only seven hours a day . . . Members of the New Brunswick legislature don't like the way members of the New Brunswick Electric Power Commission have been spending the province's money for travel. A government supporter decried the fact that the vice chairman of the commission had run up a bill of $2,807 for trips, etc, over a year's time.

M-50 Amendment Gives Utilities 30 Days' Grace

The National Production Authority at the request of the Defense Electric Power Administration has approved an amendment to M-50 giving electric utilities 30 days more in which to use materials on hand without Depa approval. The amended M-50 also contains other minor changes.

Under the original M-50 electric utilities were required to obtain Depa approval for use of materials on hand for major plant additions beginning May 1. The new amendment changes the date to June 1.

Depa officials took action to have M-50 amended when they learned that many utilities had stockpiled materials which would be installed before the beginning of June.

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Interior Defense Groups to Hold Joint Meeting

Members of the Electric Utility Defense Advisory Council and other Department of Interior defense advisory groups will meet in Washington this week to hear mobilization officials.

Defense Mobilizer Charles E. Wilson and National Production Authority Administrator Manly Fleischmann will be among the officials addressing the meeting May 9 at the department.

Interior defense agencies have seven advisory councils, and approximately 425 persons are expected to attend the meeting.

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Industry M Orders

National Production Authority has issued the following M Orders of interest to the electrical industry. Orders not of interest have been omitted. Copies of orders may be secured from National Production Authority, Washington 25, D. C., or any regional Department of Commerce office.

Amendments to Previous Orders

Amendment to M-19 permits use of **cadmium** for certain ferrous nuts, bolts, screws, and washers.

Amendment to M-49 requires anyone consuming or having more than 10 lb of contained **columbium** or **tantalum** during any calendar month to file a report and increases working inventories from a 30- to 45-day supply.

BEN LOEB, formerly with the Office of Energy and Utilities, National Security Resources Board, is serving as head of the Materials Control Branch of Depa's Material and Equipment Division

Steel Forgings Scarce

Steel forgings top the list of shortages harassing makers of heavy duty internal combustion engines, the industry advisory committee told NPA. The possibility of some relief even before CMP goes into effect July 1 was seen by the planners. They suspect that the monthly melt sheets, to be submitted by steel producers, will disclose supplies which can be diverted to essential industries without waiting for the full-dress allocation which will come in with CMP.

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Copper Defense Needs Up

Manufacturers of copper wire have changed their minds about the size of their defense business. A flood of new orders is the cause. The industry advisory committee recommended that NPA raise the amount of production which must be set aside for DO orders to 50% of output. Ten days earlier the committee thought 15% would be sufficient.

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Less Tungsten Available

Another sharp reduction in the amount of tungsten available for defense production is coming, NPA has warned. Tungsten has been at the top of the critical shortage list for several months. It will be even harder to get in July and August, NPA told makers of electronic tubes. There's no relief in sight.

Beardsley Heads Depa's Power Requirements Unit

C. R. Beardsley, retired Consolidated Edison Co of New York official, has been named chief of the power requirements branch of the Defense Electric Power Administration's Power Supply Division. The appointment made April 13 by Interior Secretary Oscar L. Chapman on the recommendation of Depa Administrator C. B. McManus filled a vacancy.

A native of Connecticut and graduate of Yale University, Beardsley served with General Electric Co; United Illuminating Co, Bridgeport, Conn.; Fred T. Ley Co, Springfield, Mass.; and Brooklyn Edison Co before going to Con Edison in 1937. At the time of his retirement this year he was director of economic and industrial development for the company.

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House and Senate Confer on Copper Duty Repeal

Senate and House conferees last week in Washington were meeting to settle on the terms of repeal of the import tax on copper of 2¢ per lb.

Both houses have passed bills calling for suspension of the duty until Feb. 15, 1953, but the Senate bill also provided for ending the suspension at the termination of the present emergency if it comes before the 1953 date. The House refused to agree to this.

Under both bills the duty is to be restored whenever the price of copper falls below 24¢ delivered Connecticut Valley.

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Less Cobalt for Television

The television industry will probably get as much cobalt in May and June as it got in April—30,000 lb—NPA told the industry. At the same time it broke some bad news about nickel. Producers of electronic tubes asked NPA for 250,000 lb of nickel for May, 225,000 lb in June and 200,000 lb in July. Cuts below these figures would endanger production for defense orders, the industry reported. But NPA said supplies available for the industry would probably be less than 200,000 lb a month. There is no indication when the cobalt shortage will be ended.

Industry Carries Its Story to Farmer

6 Private Company Executives Explain Power Policy of Investor-Owned Utilities at Forum before Farm Bureau Federation Group

The investor-owned electric utility industry which has been taking electricity to the farmer for about a half century has now taken to him the story of the private-public power controversy.

Last month at Chicago six leaders of the private companies took part in a forum before the Committee on Electric Service for Farmers. This is a policy-making group of the American Farm Bureau Federation. Speakers, supplied by the National Association of Electric Companies, explained to the farm leaders the power policy of the investor-owned companies and pointed out how the private enterprise system is being injured by federal power to the detriment of all industries.

Here are abstracts from the six talks:

G. C. NEFF

J. W. PARKER

H. B. SARGENT

P. L. SMITH

L. V. SUTTON

F. M. WILKES

P. L. Smith, President
National Association of Electric Companies

Managements of electric companies have long favored the things that most people are for: Sound soil conservation, land reclamation, irrigation, flood prevention, flood control, and improved navigation. We have been strong advocates of the Rural Electrification Act, properly administered, because we recognize that the farmer must have electric power, whether it is brought to him by private industry or by the government.

We believe, too, that waters behind any dam—government or private—should be used to the fullest extent, consistent with the other purposes for which the dam was constructed, to make economical power for all of our citizens, without preference. But we believe that government should do only those things that the people cannot do for themselves.

Where we part company with present ideas of some federal government agencies is with regard to the transmission and distribution of power created at federal government multiple-purpose projects. We feel that this is something the people can do for themselves, with private capital and not taxes collected by government from all of the people.

Louis V. Sutton, President
Carolina Power & Light Co
Edison Electric Institute

We are for flood prevention. We are for all the worthy objectives set forth in connection with hydroelectric projects. We are convinced, however, that these federal developments were, and are, being constructed with production of electric power as their first objective and nationalization of the electric utility industry as the ultimate goal.

Whatever the motive, the objectives usually described as the primary purposes are not being achieved, and soil conservation is suffering.

Soil erosion control—keeping the water where it falls—is the basic way to prevent floods. When there is nothing to hold the water where it falls, it rushes off, carrying the topsoil with it. And this valuable topsoil is the source of all life. Big dams give a measure of relief to the down river area, but the real damage is done before the water reaches the reservoir. They are doing nothing for the people upstream.

James W. Parker, President
Detroit Edison Co

It would be incorrect to argue that the entire program of federal water resources development is ill advised and uneconomic. Electric companies do not believe government should remove itself from large-scale activities such as flood prevention, conservation, and reclamation. The companies believe the government is justified in taking a hand whenever Congress has determined, on sound technical advice, that the project is government's responsibility. We believe that government should assist in the few remaining instances where real rural demands cannot otherwise be met.

Most of us think REA has done much real good, though its job is approaching completion.

Today, a clearly defined national power policy is vitally needed, actually, as a safeguard to our freedom. The elements—the basic principles of the national power policy for which the power industry stands have been clearly stated, though so far largely ignored. Here's how I would put them:

1. In a democracy Congress should set the national policy, not the office holder, not the public servant.

2. In a real democracy there must always be awareness that government credit is not limitless. The government should not do for the people what they are prepared to do for themselves. Neither should it spend public money on services already being furnished or readily available through private investment.

3. In a democracy local autonomy must be preserved and local self-rule be extended with federal services impinging only where necessary.

4. In a democracy there should be equality of treatment for all citizens.

Henry B. Sargent, President
Central Arizona Light & Power Co

A basis of understanding and cooperation among all public and private power groups would necessarily include the following:

1. Preservation of the American system of free enterprise, and the retention of the electric companies as an integral part.

2. Development of water resources in the greatest public interest.

3. Retention by government of full control over dams and reservoirs built by it so that full realization of sound flood control, irrigation, navigation, soil conservation, pollution control, and the other "constitutional" purposes will be secured.

4. Production of power at federal water projects where economically feasible, or where the national interest requires it; but in those cases subsidies should be spelled out, and Congress vote on them as such.

5. Widespread distribution of power generated at federal dams without discrimination, with any savings that might result passed on to consumers.

6. Elimination of duplication and waste of materials and power potentials.

7. Transfer of as much of the cost of projects as possible to the shoulders of the distributors of power, thus relieving federal taxpayers.

The mechanics of accomplishing effective cooperation would be relatively simple. For example, utilities of a given area, both business managed and municipal, could build the power house and install and operate the electric generating equipment at the proposed dam, at their own expense.

Under this plan, the utility would pay the government for the falling water and would furnish to the federal agency the power needed for the project. The amount to be paid for the use of the water would be established by the Federal Power Commission after an appropriate hearing and should be based on the current value of power in the area.

If none of the utilities in the area builds the power house, then the agency building the project should. In such a case electric power so generated and not used by the project itself should be sold by the agency building or operating the project. It should be sold at wholesale, without preference, to those primarily engaged in distributing and selling electric power to ultimate users.

Grover C. Neff, President
Wisconsin Power & Light Co

Taking electric service to and making it available to farms is what I call the first phase of rural electrification. This phase is rapidly drawing to a close. I am aware that as farmers apply electric power to more work, added capacity will have to be provided and lines strengthened. But this is not a part of the big expansion program going on for years. It is simply a part of the normal growth of the farm electric load.

So it seems to me that we are now entering the second phase of rural electrification. That will involve applying electric power to the various farm operations in a more efficient manner. It may require changing design and location of buildings so that the farm may avail itself of the full advantages of electric power. This is the big problem confronting us.

To my mind, the most important need in rural electrification now is to support and stress research and experimental work under the direction of men trained in agriculture but with the help and cooperation of men trained in supplying electric power.

By concentrating on this second phase of rural electrification electric service can be made worth much more to the farmers of our nation. They can be helped to avoid electrical equipment that will not do what it is advertised to do, and they can be guided to the selection of the kind and type of equipment which will make electric service do the most for them.

With few exceptions the electric operating companies have cooperated with REA so long as it was building lines to serve farmers that did not have electric service and, when necessary building generating stations where satisfactory wholesale service was not available. The only fear we have in connection with REA is that it will be used as a tool to further the interests of those who would socialize our industry through government ownership of it.

Frank M. Wilkes, President
Southwestern Gas & Electric Co

In December 1943 a new specie of federal power financing was born. Congress approved a continuing fund of $100,000 for SPA to provide for emergencies and to care for continuity of service. In 1949 this was increased to $300,000. It was made available not only for emergencies but also for renting transmission lines and purchase of electricity.

We were not very much alarmed. Even $300,000 doesn't sound like very much money. But somebody came up with a scheme to use that continuity fund as a means to induce the Rural Electrification Administration to loan money to a super-cooperative, formed by two or more operating co-ops, to construct steam plants which would sell their entire output to SPA. Also money would be loaned to the super-co-op to construct transmission lines over the entire area and make them available to SPA. This agency pays enough money to the super-cooperative to take care of operating expenses and amortization of those lines and their upkeep. At the end of 40 years SPA owns those lines by paying $10. At any time during the 40 years, SPA can take them over by simply paying out the money that has not been amortized. This continuing fund is only one method being used to expand the government power empire.

New South Dakota Loop Expands Missouri Basin Transmission Grid

Construction has begun on a 520-mile transmission loop in southeastern South Dakota, an important step in the transmission system of the Bureau of Reclamation's Missouri River Basin Project.

The loop comprises a series of 115-kv lines, 300 miles long in a southern arc and 220 miles long in a northern arc between Huron and Brookings, S. D. It is a feature of the Transmission Division of the Missouri Basin Project, which was authorized as part of the Flood Control Act of 1944 and subsequent legislation.

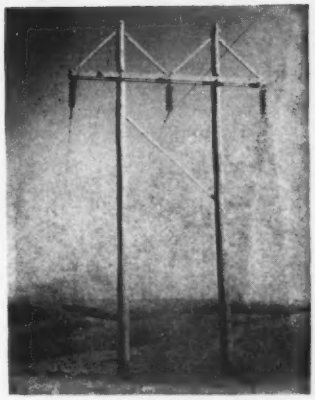
The new lines will serve communities and farming areas in the eastern end of South Dakota and are to be eventually integrated into the transmission grid and generation facilities of the Missouri River Basin. By this summer a total of 5,200 miles of transmission lines will be completed or under construction on the overall grid of the basin. And an aggregate of more than 966,000 kw will be available or approaching readiness to serve the extensive basin system.

The transmission system of the project, as authorized, extends to power market areas in Montana and Wyoming east of the Continental Divide, in North and South Dakota, in northeastern Colorado, Nebraska, western Minnesota, and northwestern Iowa. Transmission facilities over this area provide interconnection and coordination of operation of all government power plants on the project. They supply power for irrigation pumping, construction purposes, municipalities, cooperatives, private utilities, and other wholesale consumers.

Integration of transmission facilities throughout the basin-wide area requires that these transmission lines on the Missouri River Basin project be interconnected with six other bureau projects. Five are located wholly within the basin—Fort Peck in Montana; Shoshone, Riverton, North Platte, and Kendrick in Wyoming; and the Colorado-Big Thompson in Colorado, which has facilities both in the basin and west of the Continental Divide.

Interconnection of the power plants on these projects with the transmission system of the Missouri River Basin Project and private systems forms an extensive network of backbone transmission lines and secondary lines to make available delivery of both firm and secondary power to important load centers throughout the basin.

Aggregate length of the extensive network connecting the seven projects now totals about 3,900 miles; the new South Dakota loop will increase it to 4,400 miles. More than 1,500 miles of these lines are completed or under construction on the Missouri River Basin Project. Second largest transmission development is on the Colorado-Big Thompson Project, which includes more than 600 miles of 69-kv and 115-kv line.



LONG-SPAN CONSTRUCTION on South Dakota loop uses wood poles with knee and X braces. ACSR is 397,500 cm

For the remainder of the fiscal year ending June 30, 1951, the bureau is authorized to start construction of an additional 850 miles of transmission lines on four projects of the overall transmission system—Missouri River Basin, Colorado-Big Thompson, Fort Peck, and Kendrick Projects. These lines are exclusive of the 520-mile South Dakota circuit.

Largest concentration of work is on the basin project. More than 500 miles of lines, ranging from 34.5 to 230 kv are to be added to the system. These include the key transmission link from Mobridge, S. D. to Oahe, S. D. It is part of the main trunk circuit connecting the Garrison Plant in North Dakota and Fort Randall and Gavins Point Plants in South Dakota. A 4-mile, 115-kv line connecting the Williston-Garrison and Garrison-Bismarck lines completes the tie with the Fort Peck line running between Fort Peck Plant and Williston, N. D.

Also planned for construction about the end of June is a 112-mile, 115-kv line from Midland, S. D., west to Rapid City, S. D. This segment will serve REA loads in South Dakota.

Where the Power Comes From

Principal sources of energy for the integrated power system of the Missouri Basin Project are these three Corps of Engineers plants on the main stem of the Missouri River:

	Initial Capacity (Kw)	Ultimate (Kw)
Ft. Peck	100,000 (1943)	135,000
Ft. Randall	160,000 (1954)	320,000
Garrison	280,000 (1955)	400,000

Additional plants under consideration:

Gavins Point	100,000 (1956)
Oahe	425,000 (1959)

Power is also available from bureau plants totaling 153,400 kw capacity in the northern Colorado-southern Wyoming area. Principal power feature to be started in this area this year is the Flatiron Plant on the Colorado-Big Thompson project. The plant will include two generators capable of delivering 63,000 kw and one pump-turbine unit which will pump irrigation water during off-peak periods and be reversed for power generation at peak periods. With this combined power and pumping arrangement the plant can furnish peaking energy to the interconnected power system and also serve during off-peak hours to pump water to Carter Lake reservoir, one of the storage facilities on the eastern slope of the transmountain diversion project.

EDGE MOOR Plant of Delaware Power & Light Co on Delaware River near Wilmington is major part of $60-million, 5-year expansion program. Initial installation will include two 66,000-kw steam turbine generators, first expected to go on the line late in May, second by September. Another, of 70,000 kw, is planned for 1954

C of C Water Resources Statement Clashes with Most of WRPC Report

A new set of water resources policy recommendations — clashing sharply with part of the report of the President's Water Resources Policy Commission—was adopted last week by the U. S. Chamber of Commerce at its annual convention in Washington.

The chamber charged that "conservation of water resources and water resource development have been and are being used as the initial step in the socialization of natural resources industries."

In a four-point policy recommendation for the mobilization, the chamber urged that:

"1. Where water resources development should be undertaken to assist the defense effort, federal, state and local governments should confine themselves to necessary govermental functions and should not undertake projects which private enterprise is able and willing to construct.

"2. The American free enterprise system continue and be fostered in the development of water resources, subject only to usual regulatory powers of government.

"3. All federal multi-purpose projects and project activities be reexamined to determine if they contribute immediately to national defense. Only those proposals which contribute immediately to defense should be approved. All others should be eliminated from present consideration to conserve funds for defense requirements.

"4. So far as is possible and to aid in financing the federal defense effort, water resources development should be financed by private institutions, rather than by federal expenditures."

The chamber proposed power produced at federal dams be "disposed of to existing local generating, transmitting, and distributing systems" by one of three methods:

1. Private installation of the power facilities.

2. Leasing generating facilities to existing systems.

3. Selling the power at the busbar "without discrimination as to price and without discrimination or preference among applicants for power contracts."

The chamber declared the Federal Power Commission should have the same jurisdiction over rates and contracts for federal power that it does over interstate utility operations.

Utilities Set to Celebrate 95% Farm Electrification

Near-completion of the job of electrifying the country's farms will be celebrated by the power industry the week of Aug. 26, designated Rural Electrification Week.

Under the auspices of the Public Information Program and with the support of Edison Electric Institute, power companies that week will schedule special activities to mark progress made in bringing electricity to 95% of America's farms since 1923.

At that time, power will be available to 4.9 million of 5.2 million occupied farms and about 15 million of 15.5 million occupied rural dwellings. Business-managed utiities serve 47% of the farms; REA cooperatives, 49%; and government systems, 4%.

Grover C. Neff, president, Wisconsin Power & Light Co, is chairman of the committee appointed to supervise the celebrations.

The first experimental farm line, a six-mile, iron wire connecting 18 farms, was strung in 1923 near Red Wing, Minn., by Northern States Power Co in cooperation with the Farm Bureau Federation and the University of Minnesota.

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House May Cut USBR Funds in Utility Areas

The House of Representatives May 2 approved an amendment to the Interior appropriations bill for fiscal 1952 which would prevent use of Bureau of Reclamation funds for lines in areas covered by transmission contracts with private power companies.

The amendment, by Rep Kenneth Keating, New York Republican, stated no bureau funds were to be used "to initiate the construction of transmission facilities within those areas covered by power 'wheeling' service contracts which include provision for service to federal establishments and preferred customers."

As "Electrical World" went to press, this amendment and others relating to the Southeastern, Southwestern and Bonneville Power Administrations (EW, April 30, p 6) had not been brought to a roll call vote in the House. Roll calls were expected to be asked on the controversial power amendments.

28TH ANNUAL MEETING of NELPA's Engineering & Operation Section was sparked by T. A. Purton, left, general chairman; John Bankus, retiring section chairman; and George M. Gadsby, president of Utah Power & Light Co and keynote speaker

Reclamation Cutbacks Could Save $173 Million, NW Meeting Is Told

Elimination of non-essential spending contemplated by Bureau of Reclamation to further its scheme for a nationalized power system could save $173 million of taxpayers' money, George Gadsby, president of Utah Power & Light Co, told the Engineering and Operation Section of the Northwest Electric Light and Power Association at Salt Lake City on April 25. Not one penny should be spent to contribute to socialistic plans at home while money, resources, and lives are being freely spent to fight a war against socialistic imperialism abroad, he said.

Federal power planners are determined, he charged, to establish a power empire blanketing the nation. He quoted this comment by the House Committee on Appropriations referring to surveys on the proposed Bonneville-Shasta intertie: "The conclusion is inescapable that the Bureau . . . has expended funds in direct contravention of the clearly expressed intent of Congress."

Gadsby recommended to the group of more than 200 which met April 25-27, that every effort be made to influence Congress to reject proposed outlays for new federal power facilities where private industry is ready to do the job at no cost to the taxpayer.

With relief in aluminum supplies in sight after the first of next year and copper available in declining amounts because its production is not susceptible to substantial increases, Depa will foster a program to swing much of the utilities' construction to aluminum, C. T. Hurd, chief of the Materials and Equipment Requirements Branch of Depa, told delegates.

He said companies which had not been using aluminum would receive exemptions to allow them to switch their requirements from copper. He also said the situation on conductor accessories had been straightened out, with manufacturers now authorized to use DO-45 for copper, aluminum, or steel as required. Hurd added that urgency numbers assigned generating units in manufacture will have no effect on present scheduling unless there is a serious upset.

To show some of the possibilities of using aluminum conductor, S. J. Pearson, Portland General Electric Co, told the Transmission and Distribution Committee that his company's costs for No. 4 solid weather-proof aluminum are $16.15 for a conventional service, compared to $19.75 for No. 6 weatherproof copper. PGE has also used for service entrances and is trying for secondary conductor two polyethylene-insulated and one bare-stranded aluminum conductors loosely spiralled into a cable. By supporting it from a ⅜-in. steel messenger the company is able to span 260-ft blocks without intermediate poles, taking services off at midspan wherever they are needed. This effects a saving of 45% compared to the cost of conventional construction, he said.

Microwave channel routes are now being surveyed for line-of-sight clearance by use of two helicopters which hover at each end of the proposed line, Ralph Maddox, Federal Telephone & Radio Corp, reported to the electronic equipment subcommittee. Federal uses a 10,000 megacycle transmitter and receiver to send a signal from one helicopter to the other. The 'copters descend until they reach cutoff. About a 20-ft margin is generally allowed for tree interference.

Details of a heat pump installation which will use condenser cooling water from an adjacent steam generating plant to heat a new service building of Utah Power & Light were presented to the House Heating Research Committee. The 120-ton system is expected to have a coefficient of performance of 5/1, and will include an arrangement for switching over to the discharge side of the plant cooling towers for summer cooling.

C. H. Kirk, Montana Power Co, was elected as the new chairman of the section, succeeding John Bankus, Portland General Electric, who completed a two-year term.

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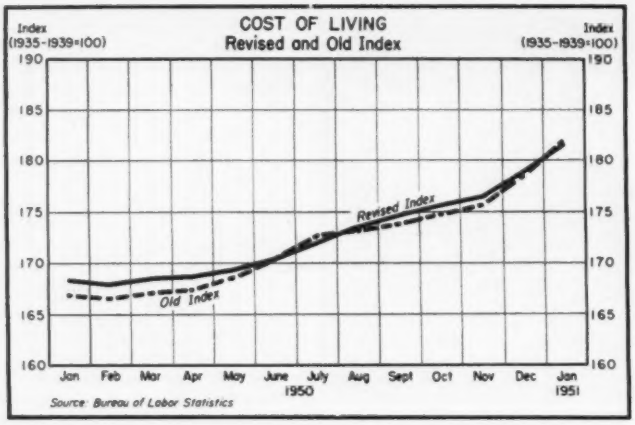
Yale License Is Issued to Pacific Power & Light

Pacific Power & Light has received a 50-year license from Federal Power Commission to construct the Yale hydroelectric development on Lewis River, 30 miles east of Woodland, Wash.

Yale Project is planned to have an initial capacity of two 50,000-kw units, with two more to be installed later. Total estimated cost is $33,-350,000.

Application for the license was made Jan. 23. FPC advised PP&L Feb. 27 that construction could begin at the company's risk because of the critical power situation in the Northwest. Defense Electric Power Administration had recommended the project, which will include a dam 205 ft high and a reservoir nine mi long.



Cost of Living Index Is Overhauled as Indicator of Controlled Economy

An interim improvement has been made in the Consumers' Price Index, better known as the Cost of Living Index, because of its added importance as an indicator of price movement in a controlled economy and as an escalator in wage contracts for 2.7 million workers. The Bureau of Labor Statistics plans to finish overhauling the index in 1952.

The improved index will be less volatile. The shift in emphasis has been to items which are more stable in price. It was determined by recent studies on how people spend their money in Washington, Richmond, Houston, Denver, Detroit, Memphis, and Manchester, N. H.

In the revision, the food group has fallen off in importance from more than 40% of the total to about one-third, although more money is actually spent on food today than in earlier years of the index. The miscellaneous group increased in importance to about the same share as foods. This reflects a better standard of living since a greater share of the family budget is now spent on education, recreation, and transportation.

Both the revised and the old indexes will be published through 1951. This will allow management and labor to change their escalator contracts from the old index tie-in to the new at any time they can agree upon. General Motors Corp has set up a plan for its own shift and will send a copy to anyone who is interested. The Bureau of Labor Statistics also will assist labor and management groups on shifting from one base to the other.

Four major revisions are included in the interim index. The improvements are ranked here in order of importance:

1. Various index items have been adjusted to take into account family spending habits just prior to the Korean War. Adjustments were based on expenditure studies mentioned above. For example, fuel oil was given greater weight, coal less; canned foods more, fresh fruits and vegetables less.

2. The new index will more accurately reflect rents. The old rent component had not reflected higher rents charged for homes built since 1940. Homes built after the war have not been under rent control.

3. Several items have been added because they have become important in the family budget. Some examples: frozen foods, baby canned foods, gas for home heating, group hospitalization, home permanents, and television sets. Other items were added because their price movements had proved to be different from those of related commodities. Among these are electric toasters, cola drinks, and ice cream.

4. The index has been adjusted to reflect population changes based on the 1950 Census. West Coast cities have increased their relative importance in the national average.

Virginia SCC Affirms Municipal's Extension

Virginia State Corporation Commission recently affirmed the right of a municipality to extend its utility lines beyond its corporation limits.

In its ruling, the commission declined to make Appalachian Electric Power Co serve 420 residents of South Salem now being served by a municipally-owned distribution system at Salem.

Fifteen South Salem residents had asked the commission to order Appalachian to serve them because, they said, they had no voice in electric rates charged by Salem. Appalachian took a neutral position in the case.

The commission held such an order would only duplicate existing facilities and would give residents of South Salem no better service and no decrease in rates.

"Certainly," the unanimous opinion said, "the commission would not order one public service company to invade the territory of another merely because some customers, without justifiable reason or grounds, prefer to be served by one company rather than another."

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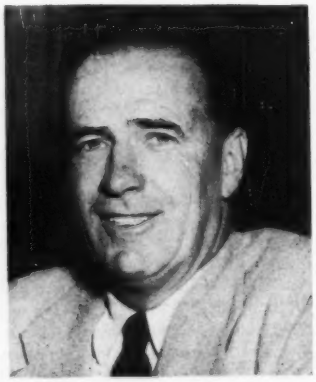
Smith Heads Commission

Paul T. Smith has been elected chairman of the Montana Board of Railroad Commissioners. Leonard C. Young has succeeded Horace F. Casey on the commission.



RICHARD D. SEARLES, Arizona rancher, was sworn in April 30 as Undersecretary of the Department of the Interior

MILLIONTH METER is about to be connected in Whittier home by W. C. Mullendore, left, president, Southern California Electric Co. Watching installation are Harold P. Huls, California PUC, and Mr and Mrs Dale B. Lillywhite, homeowners

So. California Edison Installs Millionth Meter

The millionth meter on Southern California Edison Co lines was installed recently by Pres W. C. Mullendore at a ceremony at a home in Whittier. The utility thus became the fifth in the country to reach this mark.

Mullendore personally connected the instrument in the home of Mr and Mrs Dale B. Lillywhite as Harold P. Huls, California public utilities commissioner, Mayor P. J. O'Melia, and others looked on.

"The installation of the company's one millionth meter is a significant event for Southern California, as well as for the company," Mullendore said. "This occasion spotlights the unprecedented growth and development of the 18,500-sq mi area served by the company and the tremendous influence this program has had upon the state and the entire nation."

When the company's parent, West Side Lighting Co, was founded in 1896, its system consisted of a 60-kw steam generating plant and a total connected load of five commercial arc lights and three street arcs. Today the Edison company serves 3 million persons from 29 hydro and steam plants with a total capacity of 1,761,420 kw.

Other companies that have passed the million-meter mark are Consolidated Edison Co, New York; Pacific Gas & Electric Co, San Francisco; Public Service Electric & Gas Co, Newark, N. J.; and Commonwealth Edison Co, Chicago.

•

Roanoke Rapids Case Before Circuit Court

Department of the Interior has asked the U. S. Circuit Court of Appeals to set aside Federal Power Commission's order granting a license to Virginia Electric & Power Co for the Roanoke Rapids site.

Interior's petition was filed April 27 in the Fourth Circuit Court in Richmond, Va. Respondents are FPC and Vepco. It charged the Vepco decision "puts into jeopardy all river basin developments approved by Congress, by making the realization of such developments contingent upon the nonissuance of licenses by the commission."

Arguing the Roanoke Rapids license "violates the principle" that river basins should be units of water resources development, the petition charged that "it operates against the principle established by Congress that public power should be so disposed of as to encourage the most widespread use thereof at the lowest possible rates to consumers."

The fruits of the government's investment in upstream development, Interior contended, would thus be used "for the benefit of private power companies, rather than be distributed among the people in the area."

•

Vepco to Petition FPC for 2nd Roanoke Dam

Virginia Electric & Power Co will ask Federal Power Commission for permission to build a second hydroelectric plant on the Roanoke River in North Carolina, ten miles above its proposed Roanoke Rapids dam.

The second plant, to be located at Gaston, N. C., would have a capacity of 100,000 kw, compared with 91,000 at Roanoke Rapids.

•

Reclamation Engineer Gets Colorado Medal

Leslie N. McClellan, chief engineer of the Bureau of Reclamation, has received the Gold Medal Award of the Colorado Engineering Council for "distinguished engineering service."

The medal, awarded only five times since its establishment in 1930, was presented at a banquet in Denver. Lawrence M. Robertson, Public Service Co of Colorado, pointed out McClellan had an outstanding professional record and that among other things he had developed the 10 million-kva circuit breakers for the Columbia Basin Project.

"Mac has a fine administrative ability," Robertson said, "and a fine engineering ability. The world has become a better place because of him."

L. N. McCLELLAN, left, USBR engineer, accepts medal from John McGowan, president, Colorado Engineering Council

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1951									
Apr. 26	2.87	2.94	3.03	4.03	4.30	4.57	5.35	6.96	7.07
Apr. 19	2.89	2.98	3.03	4.03	4.26	4.56	5.51	6.27	7.05
END OF QTR.									
1st 1951	2.87	2.93	3.00	3.96	4.19	4.52	5.47	6.20	7.13
4th 1950	2.65	2.67	2.78	3.86	4.14	4.51	5.80	6.54	7.44
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.25
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50

Data: Reis & Chandler, Inc.

Power Customers to Pay for Hike in Transit Wages

An hourly wage boost of 16¢ granted transit workers of the British Columbia Electric Railway Co will be paid for by the company's power customers in the form of an 11.2% increase in electricity rates.

This method of balancing-out transportation deficits evolves from a policy approved by the provincial Public Utilities Commission under which B. C. Electric is directed to consider its three operations—transit, power, and gas—as one unit for the purpose of determining the rate structures on the basis of allowable profit.

The company decided transit riders could not stand another fare boost to meet increased transit wages and has applied to the PUC for higher power rates. The rate increase will affect householders and light industry but not commercial users. The increase will apply only to industries where power is 1% or less of production costs.

Vancouver City was singled out for the greatest increase because it benefits most from the company's transit operations and because it had a lower home power rate than the rest of the lower mainland. The boost will be to put the entire lower mainland on the same rate. Hitherto the initial Vancouver residential rate had been 4¢ per kwhr, while the rest of the mainland area paid 5¢. The new rate for Vancouver and nearby areas is 5¢.

•

Merger Plan Postponed

North American Co, a utility holding company, has postponed indefinitely plans to end its corporate existence by merging into Union Electric Co of Missouri, its principal operating subsidiary. Proposed construction of a large government project connected with the rearmament program in the St. Louis area caused the postponement. The defense development would require Union Electric to build a power plant, which would be financed by North American. The holding company had planned to merge with its subsidiary to comply with the Utility Holding Company Act.

•

2 Cities Reject Acquisition of Puget Sound Property

Voters in two out of three western Washington cities have voted against proposed acquisition of Puget Sound Power & Light Co properties in their areas.

Puyallup voted 1,407 to 979 against acquisition and in Houghton the vote was 143 to 47. Sumner favored acquisition by a vote of 398 to 346.

Since Puget Power has declared it would prefer to sell the balance of its properties in one block to the PUD's, the only way Sumner can get the properties within its limits is by condemnation. This will increase to 12 the number of condemnation suits pending against the company.

British Columbia Electric to Buy 2 BCPC Systems

Special legislation has been introduced in British Columbia to legalize the sale of electric power systems at Hope and Lillooet to the British Columbia Electric Railway Co by the British Columbia Power Commission.

The question of ownership of the system has been disputed for some time by residents of the area, who charge they could purchase power more cheaply from B. C. Electric than from the power commission. The commission has been buying electricity for Hope from the private company and reselling it to consumers there.

There was no authority in the act establishing the commission to permit sale of property and for this reason special legislation has to be passed to authorize the transfer. Should the sale go through, it will be the first time BCPC has relinquished any of its holdings since it began operations in 1945.

FINANCIAL BRIEFS

Ontario's Hydro-Electric Power Commission will rebate approximately $3,342,903 to municipalities as a result of increased and unexpected revenue last year. Chairman R. H. Saunders said most of the money will be used for rehabilitation of local systems. He discouraged applications for rate reductions.

Georgia Public Service Commission has authorized Georgia Power Co to issue $20 million worth of first mortgage bonds this year to finance a $35-million construction program.

Electric Utility Financing—April 21-28

Company	Description	Amount of Offering (000)	Offering Price	Yield at Price to Public
Bonds				
Lynn Gas & Electric	20-yr notes, "A", 3¼%, 1971 new money	$4,100	100.75%	3.07%
Public Service of Oklahoma	1st mtg "C", 3⅛%, 1981 new money	10,000	99.709	3.14
Monongahela Power	1st mtg, 3⅛%, 1981 new money	10,000	101.625	3.29
Common Stock				
Gulf States Utilities	164,691 sh new money	3,664	$22.25	5.39
Pacific Lighting	369,643 sh new money	19,221	$2.00	5.77

SCHEDULED FOR FOLLOWING WEEK

Bonds—Consolidated Edison Co of New York, 1st and ref, 1981 new money, $40 million.

Common Stock—Long Island Lighting, 524,949 sh new money, $6.3 million; Ohio Edison, 436,224 sh new money, $13 million.

UWU Testifies Against St. Lawrence Seaway

Citing its difficulties with federal and public power projects, the Utility Workers Union of America, CIO, has attacked the proposed St. Lawrence Seaway and Power Development as part of a program for "the eventual nationalization of the light and power industry."

William J. Pachler, national secretary-treasurer of the union, presented the union's views to the House Committee on Public Works.

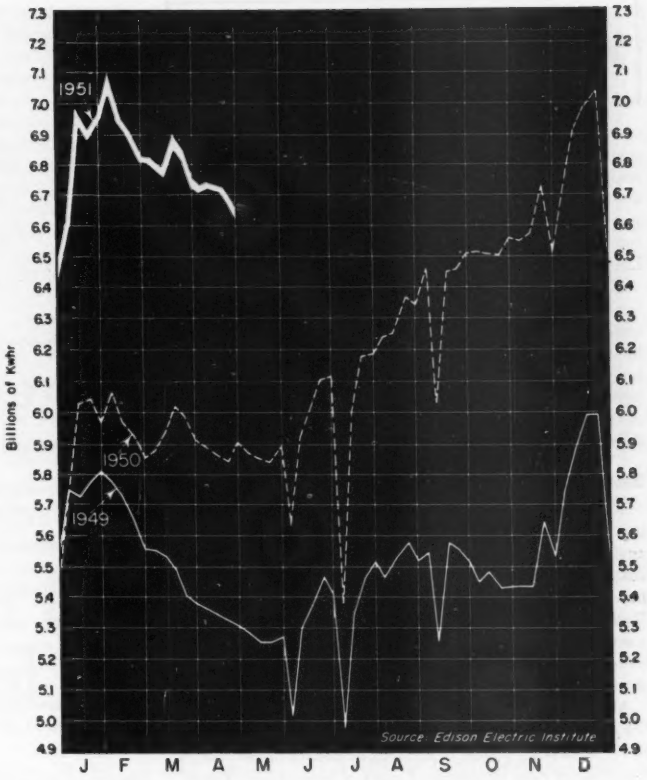
"If the St. Lawrence Seaway Power Project," Pachler said, "is constructed and put into operation under the control of the federal or New York State government, then it will be another step towards the elimination of private ownership of power facilities.'

The union, he testified, "looks with alarm upon this steady, relentless, and unfair competition with the private utilities which results in our employees being hurt."

•

Tacoma Grants 10% Raise

City Light employees at Tacoma, Wash., have accepted a 10% pay increase offered by City Council, retroactive to April 1. Fifteen classifications of workers are affected, according to L. J. Thaller, business agent of Local 483, I.B.E.W.



Output Week Ended April 28—6,673,505,000 Kwhr

Weekly Output, Millions Kwhr						Percent Change from Previous Year			
1951		1950		1949			Apr 28	Apr 21	Apr 14
Apr 28	6,674	Apr 29	5,902	Apr 30	5,364	New England	+11.1	+12.3	+12.3
Apr 21	6,730	Apr 22	5,846	Apr 23	5,126	Mid-Atlantic	+10.2	+13.6	+13.1
Apr 14	6,747	Apr 15	5,863	Apr 16	5,343	Central Industrial	+13.7	+16.7	+14.7
Apr 7	6,736	Apr 8	5,858	Apr 9	5,360	West Central	+12.4	+13.2	+14.9
Mar 31	6,767	Apr 1	5,912	Apr 2	5,378	Southeast	+14.3	+14.4	+16.0
Mar 24	6,848	Mar 25	5,993	Mar 26	5,404	South Central	+22.4	+22.9	+19.5
Mar 17	6,903	Mar 18	6,015	Mar 19	5,496	Rocky Mountain	+ 6.7	+ 7.8	+ 6.4
Mar 10	6,795	Mar 11	5,937	Mar 12	5,531	Pacific Coast	+13.2	+15.9	+18.9
Mar 3	6,822	Mar 4	5,879	Mar 5	5,552				
Feb 24	6,833	Feb 25	5,854	Feb 26	5,559	Total United States	+13.1	+15.1	+15.1

MEETINGS

Edison Electric Institute
Meter and Service Committee, jointly with Association of Edison Illuminating Companies' Committee on Metering and Service Methods, Huntington Hotel, Pasadena, Calif., May 7-9; Commercial Electric Cooking Conference, Sherman Hotel, Chicago, Ill., May 9; EEI Accident Prevention Committee, Hotel Utah, Salt Lake City, Utah, May 21-22; Electrical Equipment Committee, Hotel Biltmore, Los Angeles, Calif., May 28-29; Annual Convention, Shirley Savoy Hotel, Cosmopolitan Hotel, Denver, Colo., June 4-7.

★**Northwest Electric Light & Power Association**
Business Development Section, Multnomah Hotel, Portland, Ore., May 7-9; Personnel Section, Davenport Hotel, Spokane, Wash., May 16-18; Accounting Section, Boise Hotel, Boise, Idaho, June 14-15.

American Public Power Association
Annual Convention, Read House, Chattanooga, Tenn., May 7-9.

★**American Institute of Electrical Engineers**
District No. 5 Meeting, Loraine Hotel, Madison, Wis., May 17-19; Summer General Meeting, Royal York Hotel, Toronto, Canada, June 25-29; Pacific General Meeting, Multnomah Hotel, Portland, Ore., August 20-23.

Pennsylvania Electric Association
Joint Meeting of Electrical Equipment, Transmission and Distribution Committees, Abraham Lincoln Hotel, Reading, Pa., May 10-11; Relay Committee, Hotel Jermyn, Scranton, Pa., May 17-18; Prime Movers Committee, Penn-Belle Hotel, Bellefonte, Pa., May 24-25; Meter Committee, Irem Temple Country Club, Dallas, Pa., May 24-25.

New York Society of Professional Engineers
Engineering Industries Exposition, Hotel Statler, New York, May 10-12.

★**Interstate Power Club of New York**
Hotel Martinique, New York, May 14.

Missouri Valley Electric Association
Accounting Conference, President Hotel, Kansas City, Mo., May 17-18.

Public Utilities Advertising Association
Annual Meeting, Hotel New Yorker, New York, May 17-19.

Protective Relay Engineers
Annual Conference, Georgia Institute of Technology, Atlanta, Ga., May 18-19.

National Association of Electrical Distributors
Annual Convention, Chelsea Hotel, Atlantic City, N. J., May 20-25.

Missouri Association of Public Utilities
Annual Convention, Jefferson Hotel, St. Louis, Mo., May 21-23.

Pacific Coast Electrical Association
Annual Convention, Biltmore Hotel, Los Angeles, Calif., May 21-23.

American Society of Mechanical Engineers
Semi-Annual Meeting, Royal York Hotel, Toronto, Canada, June 11-15.

Canadian Electrical Association
Annual Convention, Algonquin Hotel, St. Andrews, New Brunswick, June 18-21.

American Society for Testing Materials
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 18-22.

★**Pacific Electronic Exhibit**
Civic Auditorium, San Francisco, August 22-24.

★**Illuminating Engineering Society**
National Technical Conference, Hotel Shoreham, Washington, D. C., August 26-30.

★Addition this week

WASHINGTON COMMENT

RONALD D. ROSS

A small mountain of technical and generally dull reading matter is perhaps the brightest new development on the nation's power scene in the past year or so. It consists of contracts under which power from federal projects will be fed into private power systems and federal preference customers will be served from privately owned electric system lines—the so-called "wheeling" agreements.

Best known of the contracts is the famed Oklahoma contract between Interior's Southwestern Power Administration and the Public Service Co of Oklahoma and Oklahoma Gas & Electric Co. Since this agreement was signed last July, Interior's Bureau of Reclamation has entered into power pacts with an impressive group of western power companies—Public Service Co of Colorado, Montana Power Co, Idaho Power Co, and Pacific Gas & Electric Co.

Each Contract Is a Bit Different

Each contract has its unique provisions, based on varying situations including political as well as geographic and engineering factors. There is, however, much in common among these agreements. Each provides for delivery of power from federal projects into private company systems. Each provides for service to federal customers by the company. For this service, there is a fee, generally 1 mill per kwhr with additional charges for long distances or small demand.

Most significantly, each of these contracts replaces plans for extensive federal transmission lines. This means savings to the American people of millions of dollars in the cost of hundreds or even thousands of miles of heavy lines. Today, it means an even more urgent economy, the savings in millions of pounds of aluminum and copper and the tons of steel required for major transmission construction. Both parties in each of these contracts may well take pride in these savings in dollars and crucial materials.

These contracts do not end the private federal power quarrel, even in the areas covered by the agreements. As we have pointed out (EW, April 23, p 98), the new PG&E-Reclamation pact is only a beginning toward power peace in Central Valley. Nor is it hard to find critics of the contracts' provisions. Both company and federal officials will point to difficulties in the contracts. The truth is that the contracts are a compromise between private and federal power views, and such a compromise does not come easily.

Who Won Is Not Important

There is a natural but unfortunate tendency to read these contracts in terms of "Who won—private company or federal agency?" This misses something far more important in these contracts. That is a pattern and policy for the marketing of federal power. It is an acceptance of the private electric utility's position that vast networks of federal transmission lines are not necessary to bring federal power to federal preference customers. This recognizes the advantages of utilizing extensive facilities of existing utilities for power transmission as opposed to constructing new systems with federal funds.

It needs to be pointed out that preference customer provisions of the law are not an issue in these contracts. Preference customers are established by law, and laws will have to be amended if the federal government is not to have preference power customers. What these contracts deal with is the problem of serving such customers so long as this law stands, and they offer a promisingly realistic solution to this problem.

How well the contracts work out in practice will depend to a large measure on the determination of all parties to make them work. If they work, the private utilities will have won an important victory in their battle to slow the expansion of federal power.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Oil-shale deposits 500-ft thick in a 1,000 square mile tract in Colorado contain 400 billion barrels of oil.

Switched capacitor installations cost about half as much per kva of rating as synchronous condensers and only 70% if the bucking capability is included.

Design studies and tentative quotations have been made for turbine generators of ratings as high as 180 Mva at 3,600 rpm.

Television microwaves can be reflected into no-reception valleys by areas of aluminum sheet mounted high in the beam path.

Aluminum containing small percentages of iron and magnesium has compression and expansion characteristics which promise to permit much larger generators for the future.

Preservative toxicity of hydrocarbon oils (whether from coal tar or petroleum) is related to the percentage of aromatics contained and boiling point-specific gravity relation.

Typical hard-drawn copper suffers a 5% loss in tensile strength in 24,000 hr at 65 C and in 2,000 hr at 80 C.

Deaeration of condensate in the condenser is getting to be the trend.

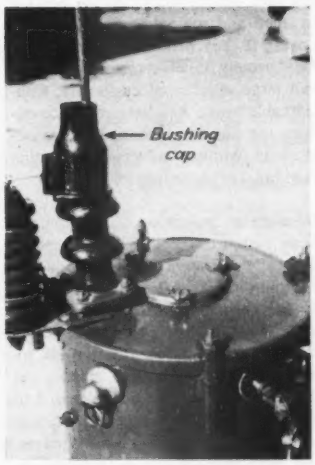
Switched capacitors properly placed can materially relieve the problem of allocating kvar among generating stations at very light load.

Ample manhole space, even if in a vertical plane, is the best answer to cable troubles arising from expansion.

Artificial respiration has a new tool—an automatic breathing instrument—with valves that alternately administers and stops oxygen in synchronism with the victim's response.

Modern power systems designed de novo would probably use only 150 kv for transmission, only 15 kv for primaries and 220/380 3-phase for secondaries.

DAMAGE CAUSED BY SQUIRRELS climbing across transformer bushings. Birds and rodents, particularly squirrels, are the second greatest cause of lateral fuse blowing and are responsible for a great deal of transformer damage



EXPERIMENTAL BUSHING CAP was designed to reduce the interruptions caused by birds and squirrels

Distribution Design Changes Bring Improved Service Reliability

OCB operations reduced from 91 to 35 and fuses blown reduced from 23 to 4 on one line through modifications that provide more spacing, better fuse coordination, and better protection from birds and squirrels

J. P. BARRON, Electrical Engineer
Dallas Power & Light Company

Modifying construction to provide two inches of air spacing per kv, plus better fuse coordination, better protection from birds and squirrels, adequate tree trimming, and other improvements have resulted in greater service continuity on Dallas Power & Light Company's distribution system. On one 13-kv distribution circuit, reworked to determine the effect of such improvements, breaker operations were reduced during the lightning season from 91 in 1949 to 35 in 1950 and at the same time lateral fuse outages were reduced from 23 in 1949 to 4 in 1950.

First step in the company's program to improve service was a study of the causes of interruptions. On systems which employ a fast trip-reclose scheme it is virtually impossible to determine the cause of a breaker operation when the breaker trips, clears the fault, and restores service with no further interruption to perhaps a hundred circuit miles of line. When the outage is caused by a blown fuse the length of line interrupted is usually shorter and can be patrolled carefully and the cause of the trouble found. But even on lateral interruptions all of the causes of trouble cannot be found, so in any analysis there will be a relatively large number of interruptions which are of an unexplained origin.

Analysis of Interruptions. . . . Table I is a partial analysis of the service interruptions, by cause as far as can be determined, for a year on a 13-kv solidly grounded neutral system employing a fast trip-reclose coordinated fuse scheme. Causes of outages fall into two general categories: Outages from permanent faults; and outages from faults which are usually temporary if interrupted quickly. Faults which are usually temporary are further broken down as to cause. Outages caused by birds and rodents, although usually permanent, are set out separately for further discussion.

Examination of Table I shows that for every 108 oil circuit breaker operations, only 26 lateral interruptions of longer than momentary duration occurred. It is these 26 lateral interruptions lasting some 15 min or longer, depending on the distance a troubleman is from the lateral, the number of such interruptions occurring simultaneously, and the amount of circuit damage, that cause the most inconvenience to the customer. However, the momentary interruptions, which

last only long enough for the breaker to open and reclose, can become annoying if they occur frequently, since they usually involve an entire feeder and large number of customers. Considerable work has been done to reduce the number of such breaker operations without adversely affecting fuse-breaker coordination.

Distance as Insulation. . . . From an examination of Table I it can be seen that, of the known causes of outages, lightning is the greatest single offender. Studies previously reported indicate that power faults following lightning strokes can be reduced materially by constructing distribution circuits so that the arc path is sufficiently long to work the air in the arc path at voltage gradients not exceeding 0.5 kv per in. and that benefits can be realized by reducing the gradient to 0.3 kv per in.

An additional reduction in power-follow faults can be realized by forcing the lightning stroke to discharge over a wood surface. This can usually be accomplished by design of the structure so that the arc path over wood is equal to or less than that through the shortest air path. Statistical evaluation of the arc quenching value of wood as applied directly to distribution circuits is not available, but laboratory experiments reported definitely indicate that it does have value.

A 13-kv overhead circuit with a fairly long exposure was selected to be reworked to find out what improvement could be obtained. Spot inspection of poles and hardware on this feeder showed that where the insulation was 2 in. per kv or better there was no indication of hardware burning due to power-follow currents. Where the insulation was one in. or less about 70% of the poles inspected had hardware burning showing evidence of flashover and power-follow. The circuit was relayed to remove the instantaneous relays only when the breaker was closed into a fault, and was equipped with three sets of single phase pole-mounted reclosers.

The line was inspected carefully by an engineer and jobs were issued to increase clearances where necessary to obtain a minimum of two in. per kv of insulation, and more where it would not increase the cost of the job. Arresters were installed where the required insulation could not be obtained. All gap-protected transformers were changed out. Coordination of all fuses was gone over carefully and in a few instances fuse sizes corrected. The trees along the circuit were trimmed where necessary. Where slack wires were found they were resagged. In general, the line was placed in the best possible condition consistent with present design knowledge. This work was done during the winter of 1949-50. The comparison of performance during the spring and summer lightning seasons of 1949 and 1950 is shown in Table III.

It is interesting to note the sharp reduction in the number of lateral fuses blown during lightning storms as well as the reduction in total fuses blown, while the number of thunder-

Table I—Interruptions To Service on a 13-Kv Overhead System With Reclosing Scheme Fuses and Breakers Coordinated

Month	Thunderstorm Days, % of Annual Total	OCB Operations per 100 Ckt. Miles	Lateral Fuses Blown Per 100 Circuit Miles					
			Permanent Faults	During Lightning Storms	Trees and Wind	Birds and Rodents	Unexplained	Total
January	0	4.1	0.33	0	0	0	0	0.33
February	10.8	3.5	0.83	0	0.33	0	0	1.16
March	8.1	9.1	0.99	0.33	0	0	0.33	1.65
April	8.1	4.0	0.16	0.33	0	0	0.16	0.65
May	21.6	25.6	0.16	3.99	0.16	0.16	1.65	6.12
June	19.0	15.2	0.50	2.02	0.50	0	0.33	3.35
July	16.2	7.0	0.33	0	0	0.66	0.82	1.81
August	5.4	6.1	1.48	0.33	0	0.50	0.49	2.80
September	2.7	8.9	0.66	0	0	0.33	0.49	1.48
October	5.4	9.6	0.33	0	0	1.32	0.66	2.31
November	0	6.9	0	0	0.16	0.50	0.99	1.65
December	2.7	8.1	0.66	0	0	1.15	0.82	2.63
Totals	**100.0**	**108.1**	**6.43**	**7.00**	**1.15**	**4.62**	**6.74**	**25.94**
Per Cent	.....	.....	**24.8%**	**27.0%**	**4.4%**	**17.8%**	**26.0%**	**100.0%**

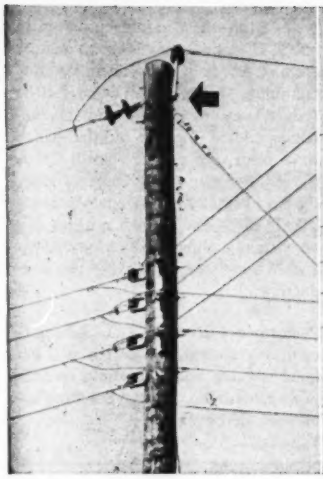
Table II—Interruptions To Service on a 13-Kv Overhead System With No Reclosing Scheme* Fuses Only Coordinated

Month	Thunderstorm Days, % of Annual Total	Lateral Fuses Blown Per 100 Circuit Miles					
		Permanent Faults	During Lightning Storms	Trees and Wind	Birds and Rodents	Unexplained	Total
January	0	4.1	0	0.8	0.8	0.8	6.5
February	10.8	2.4	0	2.4	0.8	1.6	7.2
March	8.1	4.9	7.3	0	0	0.8	13.0
April	8.1	0	0	1.6	0	0	1.6
May	21.6	2.4	26.8	0	3.2	0	32.4
June	19.0	4.1	16.2	0	1.6	0	21.9
July	16.2	2.4	4.1	0	0	3.2	9.7
August	5.4	4.1	1.6	0	0	1.6	7.3
September	2.7	0.8	0	0	5.7	0.8	7.3
October	5.4	3.3	0	0.8	8.1	5.7	17.9
November	0	2.4	0	0	2.4	3.2	8.0
December	2.7	2.4	0.8	0	4.1	3.2	10.5
Totals	**100.0**	**33.3**	**56.8**	**5.6**	**26.7**	**20.9**	**143.3**
Per Cent	.....	**23.2%**	**39.6%**	**3.9%**	**18.6%**	**14.7%**	**100.0%**

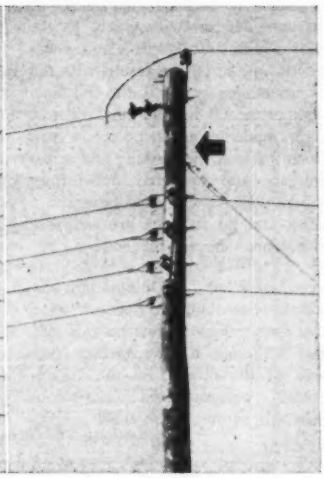
*Note: Lines with conventional overcurrent relaying

Table III—Interruptions to Service on a 13-Kv Overhead Line

	Thunderstorm Days	Station OCB Operations	Lateral Fuses Blown					
			Permanent Faults	During Lightning Storms	Trees and Wind	Birds and Rodents	Unexplained	Total
1949	17	91	0	16	0	2	5	23
1950	20	35	0	2	0	1	1	4



INSUFFICIENT SPACING between phase wire and grounded guy wire (arrow) resulted in excessive interruptions



INCREASED SPACING, to 2½ in./kv between phase and grounded guy wire gave fewer lightning interruptions

storm days is virtually the same. This comparison has been made over only one lightning season and the conclusions drawn from this comparison may be too optimistic, but there seems to be sufficient evidence that using distance as insulation is one of the better methods available for improving reliability of service.

Better Fuse Coordination. . . . The coordinated fuse-breaker scheme of relaying radial feeders is intended to reduce the effect of faults at a sacrifice in the number of interruptions. It is not new. The scheme is essentially the relaying of the station breaker to open the breaker fast enough to prevent the blowing of any fuse on the circuit and reclosing the breaker immediately or after a predetermined time. At the time of reclosure the control of the breaker is transferred from the fast relays to time delay relays that are set to protect the circuit but to allow the largest fuse on the circuit time to blow before the relays open the breaker. Also an essential part of this scheme is the fusing of the circuit so that only the fuse immedaitely ahead of the fault will blow during the time delay operation. Temporary faults should cause the breaker to open momentarily and reclose, restoring service to the circuit. Permanent faults should cause one momentary breaker operation, then blow the correct fuse. This is a good scheme but there are several refinements which can be used to advantage.

Earlier installations of this type of line protection relayed the initial opening of the breaker as fast as possible. This resulted in very frequent operation of the breaker with the attendant breaker wear and customer annoyance. After some experimenting with a delayed initial opening of the breaker, it was found that by delaying the initial opening from two to four cycles, up to 40% of the momentary breaker operaitons were eliminated, the faults being self-clearing.

It has been found that since lightning accounts for such a high percentage of temporary faults, it is necessary to reduce the time that the breaker is controlled by the time delay relays to a minimum. Otherwise, as a thunder-cloud passes over an area served by a feeder a stroke will hit, cause a fault, open the breaker and transfer tripping to time delay relays, then the breaker will reclosé, and while the breaker is under control of the time delay relays, several other strokes will hit the area, and blow fuses. This probably accounts for a very high percentage of the lateral fuses blown during lightning storms. The time the breaker is controlled by the time delays relays, following each tripout by the instantaneous relays, should be just long enough, with a reasonable fault impedance allowance, for the slowest fuse on the circuit to blow.

A modification of the coordinated fuse-breaker scheme has been devised where the time delay relays are in control of the breaker only if the breaker is closed into a fault. Only one circuit on this system has been equipped with such a scheme and that as an experiment. Additions to the substation supplying this circuit made it advisable to install supervisory equipment and this scheme was abandoned in favor of a more simple relaying circuit before substantial statistical data could be compiled.

Proof of the effectiveness of the coordinated fuse-breaker scheme can be found by comparing Table I and Table II. Table II has been prepared for lines with conventional overcurrent relaying with the same categories as to number and causes of faults as Table I. The fuses on these lines are coordinated so that only the fuse nearest the fault should blow. Breakers are equipped with time delay overcurrent relays set above the largest fuse used on the circuit protected.

It can be seen from a comparison of the tables that on a 100 circuit mile basis the feeders without the breaker coordinated with the fuses have about 5½ times as many lateral outages as the coordinated feeders. It is also very interesting to note that they have a lateral outage from lightning rate of 8 times that of the coordinated breaker feeders.

Pole-Mounted Reclosers. . . . The use of pole-mounted reclosers is a continuation of the coordinated fuse-breaker scheme. By using reclosers a feeder may be broken up into sections so that momentary interruptions affect only a section of the feeder, reducing the number of customer interruptions. The use of single phase reclosers further divides the number of customer interruptions per fault.

There are two general relaying setups for the inclusion of reclosers. In one the station fast relays are given a high current setting to operate for faults between the station and a point just beyond the recloser. The recloser then operates through an instantaneous trip-delayed trip sequence much the same as previously described for the station breaker.

There are several difficulties in op-

erating this scheme, one of which is that the coordination of the station breaker with the fuses between the station and the recloser is difficult to maintain. Another is that the time delay characteristics of present reclosers are difficult to coordinate with fuses without eliminating desirable fuse sizes from the coordinating scheme. Another difficulty of this set-up is that the recloser must be watched and maintained much as a station breaker, since it has assumed the brunt of the wear and tear occasioned by the numerous temporary faults. Also in case of a recloser failure the station breaker cannot clear low current faults.

In the second general set-up for using reclosers the station fast relays are given a low enough current setting to cover the whole line as if there were no reclosers in use. Then the fast relays are slowed down by four or five cycles by an auxiliary relay to allow the instantaneous trip of the recloser to occur without opening the station breaker.

If the fault is cleared the recloser recloses and resets. If the fault persists the recloser recloses and essentially locks closed. The station breaker then takes over and performs the same sequence as previously described. This gives the circuit two fast trips and recloseures before transferring the control of the breaker to the time delay relays. In this set-up the recloser must be protected by a coordinated fuse.

Birds and Rodents. . . . Next to lightning, birds and rodents, particularly squirrels, are responsible for more lateral fuse blowing than any other known cause. Outages in this category are usually occasioned by squirrels climbing across the transformer bushings and causing an arc which usually damages the bushing or arrester or both. As Tables I and II show, outages from birds and rodents are serious, accounting for about 18% of fuses blown, and are even more serious when the transformer damage damage from this source is taken into account.

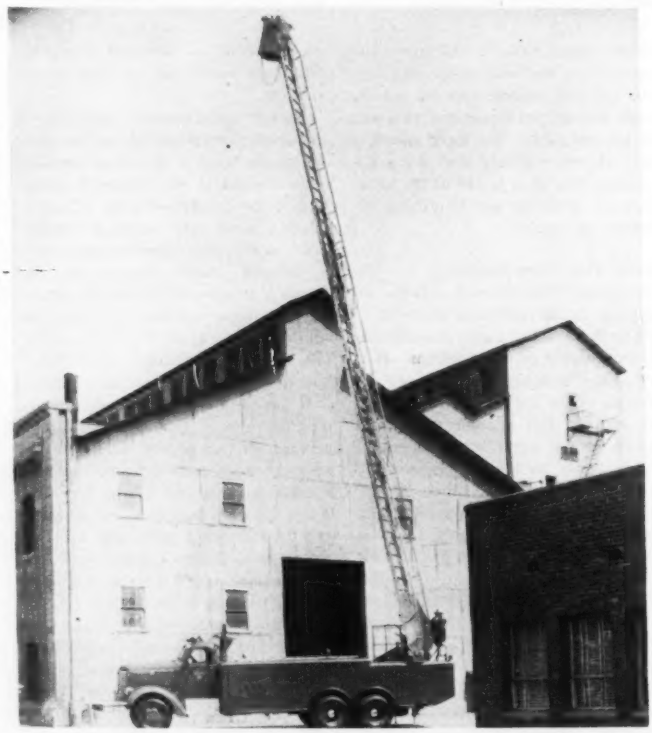
Some relief from this source of outage has been obtained by taping the exposed arrester gaps, the top of the bushing, and the transformer lead-in wire with varnished cambric and PB tape. This is expensive and does not give the relief expected. Apparently the tape deteriorates quickly to the point where a squirrel's claws penetrate it and an outage results with the arc sometimes setting fire to the tape.

Experimental installations are now being made using a porcelain cap which fits over the bushing and arrester gap, and insulated transformer lead-in wire. These installations are recent and no statistics are available to measure their effectiveness.

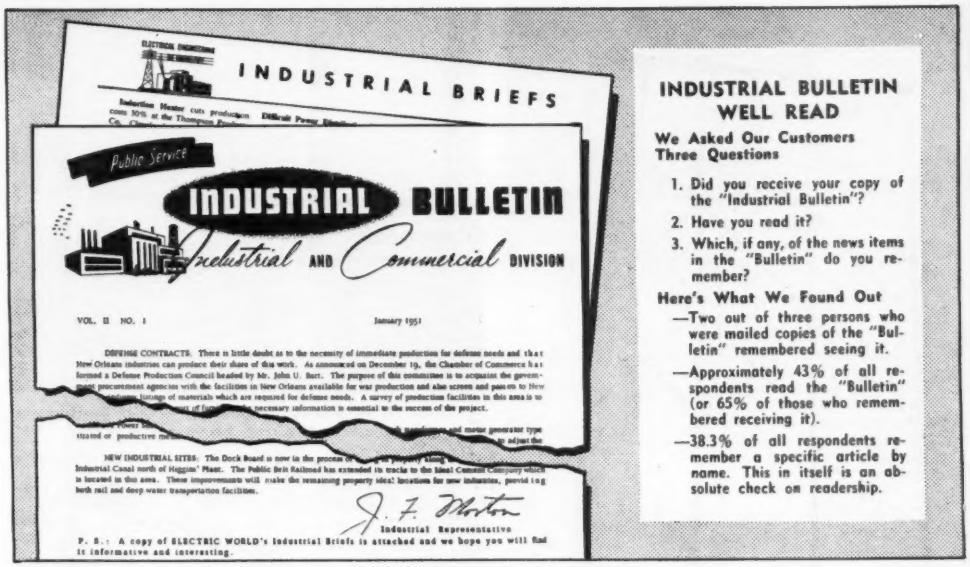
Trees and Wind. . . . Outages that can be directly attributed to trees and wind have been relatively few on this system. Although it is suspected that some of the outages in the "unexplained" category really originate from this source, this record speaks well of the tree trimming program in effect. Of course the answer to outages from trees is largely adequate tree trimming. Outages from wind can be reduced by inspection and maintenance. After the ice storms which have been occurring in North Texas there have been many cases of slack primary being blown together by moderately high winds. Such outages can be virtually eliminated by resagging, and in some cases replacing the conductors.

Performance Records . . . Advancements in distribution design will require making and publishing records of improvements and the resulting effects on performance.

Redesigned Aerial Ladder Tank Truck



INSULATORS ARE WASHED on transmission towers of Southern California Edison Co from an aerial ladder tank truck incorporating several new features. Three-axle chassis has "all-wheel" drive for rough terrain. An auxiliary engine pumps water even as the truck moves from line to line. Tank capacity is 700 gal. The 85-ft fire engine ladder is installed on the rear truck frame. All ladder movement is controlled by hydraulic valves at ladder base. Specifications were drawn up by the transportation department under C. E. Ellis, superintendent of maintenance


INDUSTRIAL BRIEFS
Public Service
INDUSTRIAL BULLETIN
Industrial AND Commercial DIVISION
VOL. II NO. 1
January 1951
DEFENSE CONTRACTS. There is little doubt as to the necessity of immediate production for defense needs and that New Orleans industries can produce their share of this work. As announced on December 19, the Chamber of Commerce has formed a Defense Production Council headed by Mr. John U. Barr. The purpose of this committee is to acquaint the government procurement agencies with the facilities in New Orleans available for war production and also screen and pass on to New Orleans listings of materials which are required for defense needs. A survey of production facilities in this area is to
NEW INDUSTRIAL SITES: The Dock Board is now in the process of
Industrial Canal north of Higgins' Plant. The Public Belt Railroad has extended its tracks to the Ideal Cement Company which is located in this area. These improvements will make the remaining property ideal locations for new industries, providing both rail and deep water transportation facilities.
J. F. Morton
Industrial Representative
P. S.: A copy of ELECTRIC WORLD's Industrial Briefs is attached and we hope you will find it informative and interesting.
INDUSTRIAL BULLETIN WELL READ
We Asked Our Customers Three Questions
1. Did you receive your copy of the "Industrial Bulletin"?
2. Have you read it?
3. Which, if any, of the news items in the "Bulletin" do you remember?
Here's What We Found Out
—Two out of three persons who were mailed copies of the "Bulletin" remembered seeing it.
—Approximately 43% of all respondents read the "Bulletin" (or 65% of those who remembered receiving it).
—38.3% of all respondents remember a specific article by name. This in itself is an absolute check on readership.

Industrial Bulletin Builds Customer Usage

J. F. MORTON, Supervisor, Industrial Section
Industrial & Commercial Division, New Orleans Public Service, Inc.

Brief articles in an Industrial News Bulletin were found to be one of the most effective and least expensive means of reaching industrial customers and promoting greater use of service.

Utilities have always found their industrial customers hard to reach with direct mail advertising. Time after time beautifully prepared pieces go out, with negligible results through direct returns. These results have often been justified with the thought that although the returns have been poor, the long range educational value is worth the cost and effort to produce the program.

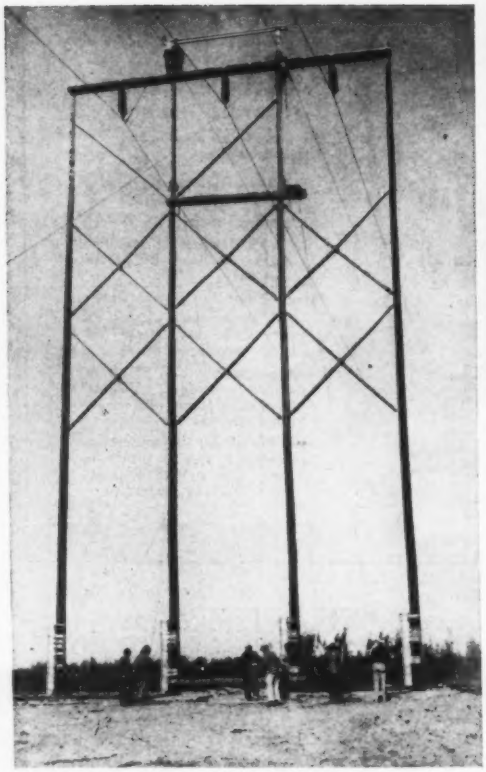
As an experiment we tried reaching this class of customer through the medium of a monthly news bulletin. If this could be kept brief, interesting, and easy to read, it might accomplish what our direct mail advertising failed to do.

While the bulletin was in the preparation stage we realized it would make an excellent vehicle for enclosure material which followed the same style as the bulletin—brief, interesting, and to the point. With this in view "Electrical World" was asked if they would reproduce their "Industrial Briefs," which they did. The "Briefs" have continued to furnish excellent supporting material for subsequent issues of the "Bulletin."

The "Industrial Bulletin" is mailed to approximately 400 selected industrial customers of New Orleans Public Service Inc. After several issues had been mailed out, it was decided to determine its acceptance and to what degree it was being read by our customers. Fifteen percent of the customers receiving the bulletin were selected at random from our mailing list. The respondents chosen were personally interviewed by the industrial representatives handling these accounts. Interviewers were furnished with only three simple questions to ask their customers and results of the interview were recorded on a survey card. This survey convinced us that the "Industrial Bulletin" is not only well recognized by the customer receiving it, but is being read and well received. As shown above approximately 43% of all respondents read it and 38% remembered a specific article by name.

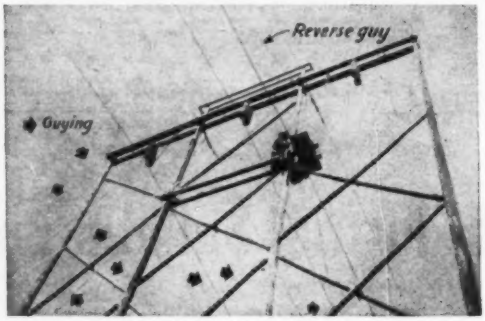
After six months use of the "Bulletin," we are still very pleased with the results accomplished. We find that brief articles on new industrial processes have created more direct results than any other material used. To be specific, description of the Hot Spray Paint Process and Infra-Red Degreasing brought in many inquiries as to the supplier of the equipment, and present users in the area.

We realize that in its present form our "Bulletin" lacks a great deal in the way of dress-up to gain eye appeal. We have in mind the use of sketches and possibly photographs to accomplish this purpose. However, it is an inexpensive and effective way to promote greater use of industrial electric service.



1 **CREW PLACES RIGGING** before starting to skid four-pole, 132-kv structure a distance of 125 ft to a prepared concrete pad. Caving river bank prompted moving the structure

2 **STEEL PILING** and pad, like this one to which structure was originally lashed, were ready before moving began

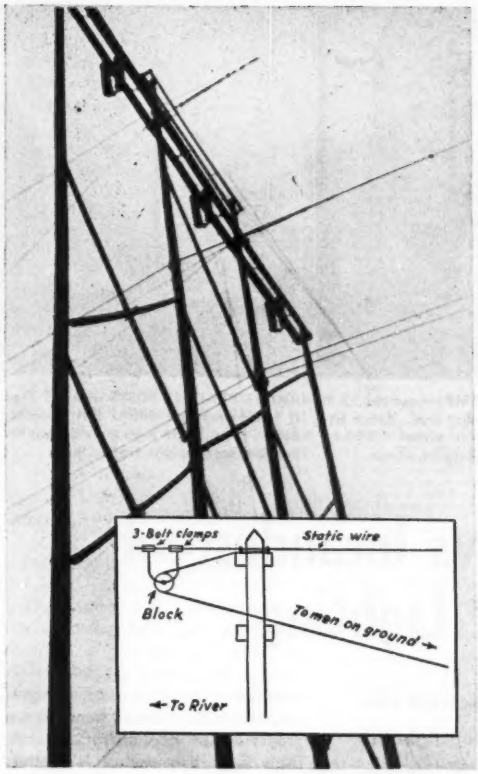


3 **REVERSE GUYING EFFECT** was obtained when guying toward river. Lines were run from pole tops to blocks hanging from shield wire, and then back to shore side to structure

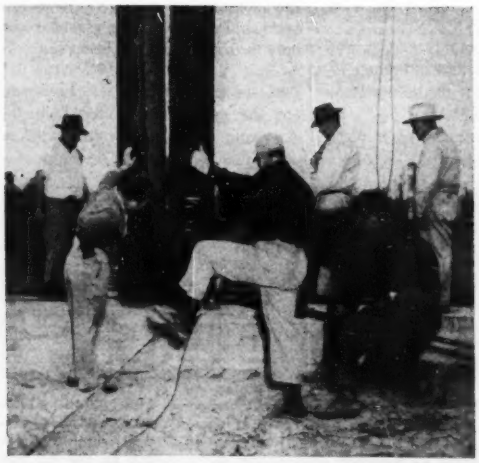
5 **UNNEEDED RIGGING** was dropped from its supporting messenger

6 **ON SKIDS**, unlashed structure slides from old piling at left

7 **CREW** steadies structure, moves skids as winches on trucks pull it



4 BLOCKS suspended from shield wire provide the means to hold structure in direction of river during skidding operation. Guys were run from pole tops to the blocks



8 MOVE COMPLETED, the structure slips safely into position alongside new piling to which it is lashed as in Fig 2

Skid 4-Pole 132-Kv Structure 125 Ft

New construction work and out-of-service time held to a minimum by intricate support guying and sliding into position by truck winches

When Southwestern Gas & Electric Co of Shreveport, La., was faced with the problem of moving a four-pole, 100-ft structure (Fig 1) on a 132-kv line, the job was accomplished by skidding it a distance of 125 ft to its new location. The job was prompted by caving of the Red River bank near Texarkana, Tex. (Fig 2) dangerously near the original location.

The structure was guyed four ways during the moving process. At the start of the operation it was so near the river, guys could not be placed on the river side. To overcome this, the structure was rigged with blocks suspended from loops of guy wire bolted to the shield wires on the river side. Guys were run from the top of the poles through the blocks and back so that men standing well behind the structure could hold strain (Fig 3). Details of this are shown in drawing (Fig 4). This rigging is also shown in Fig 4. After dark, upon completion of the job a lineman rode the static wire out to remove the three-bolt clamps and lower the blocks and rigging (Fig 5).

Due to soil conditions the four-pole structure was set on a concrete foundation and lashed to steel piling having an outside diameter of 16 in., set 40 ft deep, and filled with reinforced concrete (Fig 2).

After rigging sufficient guying to keep structure under control (Fig 6), the lashing holding structure (at right) to piling (at left) was removed. Butts of poles were then placed on the skids and slid toward new location. Timbers were fastened to butts of poles to keep lower part of structure rigid. The structure was pulled along the way by winches on trucks.

Overall view of the operation is shown in Fig 7 as structure moves to new location. Only two poles can be seen in Fig 7, showing the structure proceeding on its way. Some crew members hold guys to maintain balance, while other crew members move the skidding.

All hands show interest in seeing structure slide into position alongside new piling and on new concrete pad (Fig 8). Note that method of support is the same in new location as poles rest on concrete pad and are lashed to steel piling filled with reinforced concrete.

MERCURY VAPOR, 400-w E-HI lamps with IES Type III luminaires 30 ft high provide illumination that meets accepted quality and quantity standards

INCANDESCENT LAMPS mounted 25 ft high on an 8-ft bracket arm. These fixtures are suitable for either 6,000-lm or 10,000-lm incandescent lamps

DOUBLE BRACKET POSTS with IES Type III luminaires and 400-w E-HI mercury vapor lamps 30 ft high provide quality illumination on eight traffic lanes

Mercury Vapor vs Incandescent For Street Lighting

Mercury costs 85% to 88% as much as incandescent and the quality meets all requirements for street lighting purposes. Trend toward more efficient light sources and higher values of illumination favors mercury vapor

F. D. WYATT, Electrical Engineer, Chicago Park District, Chicago, Ill.

Present trend in street and highway lighting is toward more efficient light sources and higher values of illumination on the pavement. The mercury vapor lamp, which is more efficient than any incandescent source, is well suited to this trend and is finding increasing popularity with the designers of street lighting systems.

With the development of modern refractor type luminaires, designed specifically for mercury vapor lamps, proper control of flux from the relatively large light source is obtained to make the mercury system comparable with the incandescent system in both efficiency and distribution. As a result, it will be shown in the following economic comparisons that the advocates of the mercury system are justified in claiming greater economy in installation and operation.

Basis of Comparison . . . Following are the conditions upon which the economic comparisons are based:

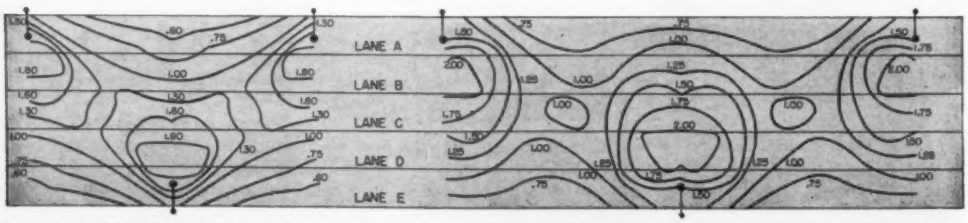


FIG 1—LIGHT DISTRIBUTION for IES Type III luminaires with 10,000-lm incandescent lamps mounted 25 ft high with 76.5- ft staggered spacing and 6-ft overhang, on a street 50-ft wide. Averages (ft-c): Entire street, 1.13; Lane A, 0.83; Lane B, 1.27; Lane C, 1.44.

FIG 2—ISOLUX CURVES for IES Type III luminaires with 20,000-lm mercury vapor lamps 30 ft high with 124-ft staggered spacing and 6-ft overhang, on a street 50-ft wide. Light distribution is well within the 4:1 ratio of average to minimum illumination recommended by the IES and ASA. Lighting intensity meets accepted standards. Averages (ft-c): Entire street, 1.14; Lane A, 0.92; Lane B, 1.31; Lane C, 1.42

Roadway—100 ft Curb-to-Curb
Mounting Height—30 ft
Luminaire Overhang—6 ft
Incandescent Luminaire—Type IV
Lamps—15,000 lm series incandescent
15,000 lm multiple incandescent
Mercury Luminaire—Type III
Lamp—20,000 lm E-HI mercury vapor
1.5 ft-c required to be maintained in service.

Roadway—50 ft Curb-to-Curb
Mounting Height—25 ft for incandescent
30 ft for mercury
Luminaire Overhang—6 ft
Incandescent Luminaire—Type III
Lamps—10,000 lm series incandescent
10,000 lm multiple incandescent
Mercury Luminaire—Type III
Lamp—20,000 lm E-HI mercury vapor
1.0 ft-c required to be maintained in service.

The assumed conditions chosen for this discussion have been selected to conform with those in the article, "Does Mercury Street Lighting Cost More Than Incandescent?" by Messrs. Johnson and Enos, presented in the April 10, 1950 issue of "Electrical World."

In the above mentioned article, a mercury luminaire with a Type II distribution was chosen. This type of luminaire was unsuited for the theoretical street considered and this error has materially affected the analysis. The accompanying isolux curves show that a mercury system utilizing Type III distribution rather than Type II gives uniformity comparable to the incandescent system. They are well within the 4 to 1 ratio of average to minimum illumination defined by the Illuminating Engineering Society Street and Highway Lighting Committee and the American Standards Association as desirable limits for acceptable light distribution and visibility on urban traffic streets.

It is apparent from the accompanying isolux curves, that both the mercury and incandescent systems are well within the limits set by Illuminating Engineering Society recommendations.

TABLE I—Incandescent vs Mercury Street Lighting
For Roadway 50 ft Wide—1 Mile Long

Illumination Data	Incandescent		Mercury Vapor	
	Series	Multiple	Series	Multiple
1. Lamp type	PS-40	PS-40	E-HI	E-HI
2. Initial lumen rating	10,000	10,800	20,000	20,000
3. Mean lumens	9,100	8,550	17,250	17,250
4. Rated lamp life in hours	3,000	3,000	4,000	4,000
5. Rated average life in service hours	2,500	2,500	4,000	4,000
6. Luminaire light distribution type	IES-III	IES-III	IES-III	IES-III
7. Roadway width, curb to curb	50 ft	50 ft	50 ft	50 ft
8. Mounting height	25 ft	25 ft	30 ft	30 ft
9. Overhang	6 ft	6 ft	6 ft	6 ft
10. Photometric curve number	313457	313457	313645	313645
11. Coefficient of utilization	.42	.42	.36	.36
12. Selected illumination value to be maintained in service	1.0 ft-c	1.0 ft-c	1.0 ft-c	1.0 ft-c
13. Staggered spacing calculated for in service values	76.5 ft	72 ft	124 ft	124 ft
14. Total units per mile of roadway	70	74	43	43
15. Calculated average initial ft-c	1.10	1.26	1.08	1.08
16. Ratio average to minimum from isolux curves, all traffic lanes	1.64	.....	1.61	.....
17. Ratio max. to min. from isolux curves, all traffic lanes	2.76	.....	2.85	.....
Installed Cost Analysis				
18. Estimated power cost				
A. Rated watts per lamp	505	620	400	400
B. Losses for insulating transformer or ballast	.....	.....	37	47
C. Misc. line losses 10%	51	62	44	45
D. Total watts per unit	556	682	481	492
E. Annual operating hr per unit	4,000	4,000	4,000	4,000
F. Annual kwhr per unit	2,224	2,728	1924.0	1968.0
G. Power cost per unit per year @ $0.010/kwhr	$22.24	$27.28	$19.24	$19.68
19. Estimated maintenance cost				
A. Lamp operating hours in service	2,500	2,500	4,000	4,000
B. Lamp cost (list price less 36% & 2%)	$1.52	$1.20	$10.66	$10.66
C. Labor cost to renew one lamp	$1.00	$1.00	$1.00	$1.00
D. Cost to renew one lamp	$2.52	$2.20	$11.66	$11.66
E. Renewals per year	1.6	1.6	1.0	1.0
F. Annual lamp renewal cost	$4.03	$3.52	$11.66	$11.66
G. Cost of washing units (twice per year, group basis)	$1.40	$1.40	$1.40	$1.40
H. Cost—minor repairs & replacements	$3.00	$3.00	$3.00	$3.00
I. Maintenance cost per unit per year	$8.43	$7.92	$16.06	$16.06
20. Construction & installed cost data				
A. Installation cost per unit	$303.02	$298.80	$374.56	$367.96
B. Installation cost per mile (Lighting units only)	$21,211.40	$22,111.20	$16,106.08	$15,892.28
C. Underground system per mile	$72,445.60	$71,239.12	$70,359.04	$67,009.92
D. Total installed cost per mile	$93,657.00	$93,350.32	$86,465.12	$82,832.20
21. Annual fixed charge—15% of installed cost for interest, taxes and depreciation	$14,048.55	$14,002.55	$12,969.77	$12,424.83
22. Total annual maintenance cost	$590.10	$586.08	$690.58	$690.58
23. Total annual power cost	$1,556.80	$2,018.72	$827.32	$846.24
24. Total annual cost of lighting	$16,195.45	$16,607.35	$14,488.67	$13,961.65
25. Annual cost per ft-c on the pavement per mile	$16,195.45	$16,607.35	$14,488.67	$13,961.65
26. Ratio of cost for equal results	100%	102.7%	89.5%	86.2%
Our own experience in street lighting forms the basis for three revisions in the above comparisons. The revisions are based on a lamp life of 5,200 hr for the E-HI lamp, a total of 4,200 operating hr per year for latitude 41° 45' N and an indicated energy charge of $0.0115 per kwhr. These new values will result in the following cost comparisons.				
21. Annual fixed charge	$14,048.55	$14,002.55	$12,969.77	$12,424.83
22a. Total annual maintenance cost	$604.10	$599.40	$594.26	$594.26
23a. Total annual power cost	$1,879.50	$2,437.56	$998.89	$1,021.68
24a. Total annual cost of lighting	$16,532.15	$17,039.51	$14,562.92	$14,040.77
25a. Annual cost per ft-c on pavement per mile	$16,532.15	$17,039.51	$14,562.92	$14,040.77
26a. Ratio of cost for equal results	100%	103.0%	88.0%	85.0%

Energy Costs . . . One of the chief advantages of the mercury vapor lamp is its relatively lower kwhr consumption for equal light output. This advantage is proportional to the power rate—the higher the energy charge, the greater the advantage favoring the mercury vapor lamp. A survey of published rates indicates that a value of at least $0.010 to $0.012 per kwhr is suitable for use as an average figure for the compilation of a cost comparison. The lower rate used in this comparison, $0.010 per kwhr, is undoubtedly too low for most areas and it favors the incandescent system, but the correct local energy rate may be substituted for specific comparison.

The 20-amp series circuits used in the previous article undoubtedly favor the incandescent system due to the elimination of individual lamp transformers for incandescent lighting, but not for mercury lighting. However, wide experience where individual lamp transformers are omitted has indicated some increase in maintenance cost due to destructive arcing when cutouts do not break down promptly following lamp failure.

Installed Costs . . . The installed cost of the complete standard, including luminaire, bracket arm, mast, base, transformer, and foundation is higher for mercury than for incandescent.

TABLE II—Incandescent vs Mercury Vapor Lighting
For Roadway 100 ft Wide—1 Mile Long

Illumination Data	Incandescent		Mercury Vapor	
	Series	Multiple	Series	Multiple
1. Lamp type	PS-40	PS-52	E-HI	E-HI
2. Initial lumen rating	15,000	15,300	20,000	20,000
3. Mean lumens	13,350	13,158	17,250	17,250
4. Rated lamp life hours	3,000	3,000	4,000	4,000
5. Rated average life in service hours	2,500	2,500	4,000	4,000
6. Luminaire light distribution type	IES-IV	IES-IV	IES-III	IES-III
7. Roadway width, curb to curb	100 ft	100 ft	100 ft	100 ft
8. Mounting height	30 ft	30 ft	30 ft	30 ft
9. Overhang	6 ft	6 ft	6 ft	6 ft
10. Photometric curve number	313,635	313,635	313,645	313,645
11. Coefficient of utilization	0.48	0.48	0.46	0.46
12. Selected illumination value to be maintained in service	1.5 ft-c	1.5 ft-c	1.5 ft-c	1.5 ft-c
13. Staggered spacing calculated for in service value	43 ft	42 ft	53 ft	53 ft
14. Total units per mile of roadway	123	126	100	100
15. Calculated average initial ft-c	1.67	.....	1.73	.....
16. Ratio average to minimum from isolux curves—6 center traffic lanes	1.08	.....	1.30	.....
17. Ratio max to min from isolux curves—6 center traffic lanes	1.18	.....	1.58	.....
Installed Cost Analysis				
18. Estimated power cost				
A. Rated watts per lamp	773	860	400	400
B. Losses for insulating transformer or ballast, watts	0	0	37	47
C. Misc. line loss—10%, watts	77	86	44	45
D. Total watts per unit	850	946	481	492
E. Annual kwhr per unit (watts x 4000 hr)	3400	3784	1924	1968
F. Power cost per unit per year, at $0.010/kwhr per yr	$34.00	$37.84	$19.24	$19.68
19. Estimated maintenance cost				
A. Lamp operating hr in service	2,500	2,500	4,000	4,000
B. Lamp cost (list price less 36% and 2%)	$1.76	$2.57	$10.66	$10.66
C. Labor cost to renew one lamp	$1.00	$1.00	$1.00	$1.00
D. Cost to renew one lamp (B) + (C)	$2.76	$3.57	$11.66	$11.66
E. Renewals per year—annual operating hr/lamp life service	1.6	1.6	1.0	1.0
F. Annual lamp renewal cost (D) x (E)	$4.41	$5.71	$11.66	$11.66
G. Cost of washing units (twice per year-group basis)	$1.40	$1.40	$1.40	$1.40
H. Cost of minor repairs and replacements	$3.00	$3.00	$3.00	$3.00
I. Maintenance cost per unit per year (F)+(G)+(H)	$8.81	$10.11	$16.06	$16.06
20. Construction and installed cost data				
A. Installation cost per unit	$313.96	$313.07	$374.56	$367.96
B. Installation cost per mile (lighting units only)	$38,617.08	$39,446.82	$37,456.00	$36,796.00
C. Underground system per mile	$78,051.16	$76,524.28	$76,044.00	$71,984.00
D. Total installed cost per mile	$116,668.24	$115,971.10	$113,500.00	$108,780.00
21. Annual fixed charge 15% of installed cost for interest, taxes and depreciation	$17,500.24	$17,395.66	$17,025.00	$16,317.00
22. Total annual maintenance cost (14) x (19I)	$1,083.63	$1,273.86	$1,606.00	$1,606.00
23. Total annual power cost (14) x (18F)	$4,398.48	$4,767.84	$1,924.00	$1,968.00
24. Total annual cost of lighting sum of (21), (22) & (23)	$22,982.35	$23,437.36	$20,555.00	$19,891.00
25. Annual cost per ft-c on the pavement per mile	$15,391.56	$15,694.91	$13,703.33	$13,260.66
26. Ratio of cost for equal results	100%	102.0%	89.4%	86.4%

Our own experience in street lighting forms the basis for these revisions in the above comparisons. The revisions are based on a lamp life of 5,200 hr for the E-HI lamp, a total of 4,200 operating hr per yr for latitude 41° 45' N and an indicated energy charge of $0.0115 per kwhr. These new values will result in the following cost comparisons.

21. Annual fixed charge—15% of installed cost for interest, taxes and depreciation	$17,500.24	$17,395.66	$17,025.00	$16,317.00
22a. Total annual maintenance cost	$1,111.92	$1,310.40	$1,382.00	$1,382.00
23a. Total annual power cost	$5,049.15	$5,756.94	$2,323.23	$2,376.36
24a. Total annual cost of lighting	$23,661.31	$24,463.00	$20,730.23	$20,075.36
25a. Annual cost per ft-c on the pavement per mile	$15,774.21	$16,308.66	$13,820.15	$13,383.57
26a. Ratio of cost for equal results	100%	103.3%	87.8%	84.8%

For an installation of any size, such as the one mile of roadway used here, the small price difference favoring incandescent disappears due to the greater number of incandescent lampposts required and the total installed cost of the lighting system only, favors mercury.

Because the incandescent system requires more standards per mile, its underground system requires more handholes, more duct, and more cable and the total underground installation cost also favors the mercury vapor system.

The only factor favoring the incandescent system is the annual maintenance cost. This annual maintenance cost, however, is only a small part of the total annual cost of lighting and the cost difference for maintenance may be ascribed to the higher initial cost of the mercury vapor lamp. Contrary to present published data, it has been our experience that the average life of present mercury vapor lamps is in excess of 5,000 hr and this figure will minimize even that small advantage of the incandescent system.

These economic comparisons have been based on prevailing costs for material and labor as of November 1, 1950, in installations made by the author. The installed unit cost includes lamp, standard, cable, duct, and control transformer. It is granted that labor and installation costs vary widely with locale. This comparison applies only to the specified street, this locale, and the specified conditions. Every installation is an engineering problem in itself and all the factors pertinent to it alone must be considered separately and balanced before making a decision.

Quality of Lighting . . . In the article published previously, and referred to above, the mercury system is criticized on the basis of several disadvantages apart from any consideration of cost. While some disadvantages do exist, they are not so serious as to warrant abandoning the mercury vapor system. The objection to the inherent color of the mercury arc is understood but it must be remembered that uncorrected mercury lamps are not used for color comparisons or the lighting of fresh foods even though they are becoming increasingly popular for storefront highlighting. Mercury lamps are being used primarily for lighting roadways with the object of reducing accident rates and in this respect color may be discounted as of little importance.

Power Factor . . . In discussing series circuit power factor the previous article claims that, "development of regulating transformers with improved power factor for the series mercury system has not yet reached the stage of practical application." Actually the constant current transformer with capacitor is, and has been for some time, a very practical solution to the problem of maintaining high overall power factor for series circuits feeding mercury vapor lamps. This transformer reduces the primary kva per lamp from 1.16 (required by transformer without capacitor) to only 0.54 kva per lamp which compares favorably with the 0.48 kva per lamp when high power factor multiple ballasts are used.

Inspection of prevailing energy rates as set up by public utility engineers further emphasizes this point by showing very little, if any, difference between the rates for E-HI mercury vapor lamps and 15,000 lm incandescent lamps. Also, the claim that a

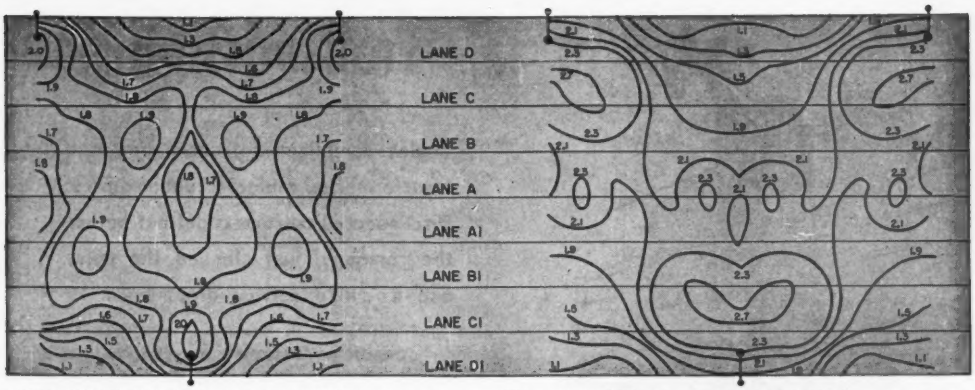


FIG 3—IES TYPE IV luminaires with 15,000-lm incandescent lamps 30 ft high with 43-ft staggered spacing and 6-ft overhang, on a street 100 ft wide. Averages (ft-c): Entire street, 1.72; Lane A, 1.79; Lane B, 1.82; Lane C, 1.77; Lane D, 1.52

FIG 4—IES TYPE III luminaire with 20,000-lm mercury vapor lamp 30 ft high with 53-ft staggered spacing and 6-ft overhang, on a street 100 ft wide. Averages (ft-c): Entire street, 2.00; Lane A, 2.15; Lane B, 2.15; Lane C, 2.10; Lane D, 1.62

15% voltage dip will cause lamp outages is in direct contrast to lamp manufacturer's data showing that a dip of 30% or more is required on either low voltage multiple or constant current series circuits to cause outages.

Photometric Data . . . The author seriously questions not only the photometric data presented in the previous article but also the interpretation of those data. It was implied that a spacing was calculated to provide a minimum of 1.62 ft-c in a traffic lane. But, how can minimum ft-c in a traffic lane be calculated when its location on the roadway is not specified? A street 100 ft wide would have two parking lanes and eight traffic lanes, each 10 ft in width or eight traffic lanes 12½ ft wide. The traffic lane specified in the report should be located with respect to the center line of the street. Minimum ft-c values are usually determined from point by point calculations after luminaire spacings have been established or by use of isolux curves of equal ft-c values.

If light distribution patterns are selected according to American Standards Association Street Lighting Practice for correct spacing and mounting height ratios for specific lamps, the accepted practice would be to designate a ft-c value to be maintained in service and use the standard formula,

$$\text{Average Illumination (ft-c)} = \frac{\text{Bare Lamp lm} \times \text{Coefficient of Utilization}}{\text{Spacing} \times \text{Street Width}}$$

to solve for spacing between luminaires. Only after a spacing has been definitely established can the usual methods be employed to check uniformity, average values, and ratios between maximum and minimum.

Lamp Life . . . Our experience indicates that the mercury vapor lamp manufacturers are conservative in their lamp life ratings. Of the Type E-HI mercury lamps installed by the author in 1948 and 1949, 46 percent are still in service and have an average age of 7017 hr. Including the lamps which failed with a short life, the indicated life of all lamps used is 5,200 hr and there is every reason to believe that the lamps manufactured since January of 1950 will have a longer life than the earlier ones. Eliminating the seven percent of the total lamps which failed within 150 hr, the indicated average life for the remainder of the lamps is 6,000 hr.

Light Per Dollar . . . According to the standard and accepted method of evaluating street lighting, the mercury vapor system provides more light for the dollar spent in the several installations of both types made by the author. In quality, mercury compares favorable with an equivalent incandescent system. Its few disadvantages are more than balanced by its economy of operation.

Intensity Doubled on Downtown Street

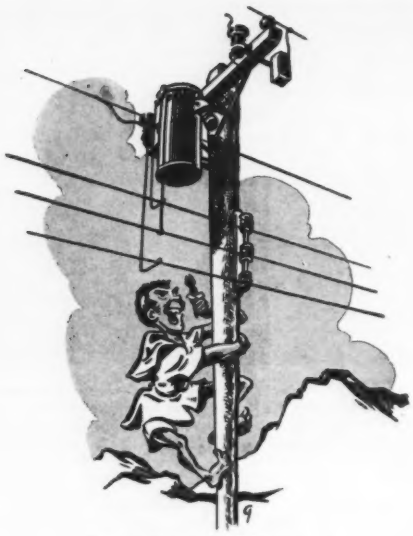
General Electric Co photo

MERCURY VAPOR luminaires mounted 30 ft above the street in Decatur, Ala. provide 1.8-ft-c intensity—more than 150% of IES recommendations for main arteries. The installation was comprised of 119 16,000-lm units. Recent rate reduction granted by Decatur Electric Dept will let city pay for installation

Transmission and

Eagles complicated transmission and transformer oil replaced rubber gloves. Disconnected customers did not bother the company, just climbed the poles and hooked service drops back on

GORDON H. SIMMONS*, Arlington, Va.



Every customer a lineman . . .

Electricity transmission and distribution in Korea are unique in many ways. Although the system was built by the Japanese during their forty years of occupation, an American engineer would readily believe that the country had been supplied 100% by American firms. The Japanese faithfully duplicated our designs in all ways except that of capacity. A transformer or a generator was rated at its overload capability and any attempts to exceed this rating caused burnouts.

Extending down the center of the peninsula from the 38th parallel to Pusan was a 132-kv steel tower transmission line. Every other tower contained an eagle's nest, approximately four feet in diameter. An eagle could sit on the edge of his nest and pick an insect off the wire. It is presumed that many did because of the frequent high-line disturbances while I was there. Occasionally a lineman would pick up a fried eagle.

This transmission line extended across the Han River. Because of the long span, the lines sagged low. Some Koreans in a small sailboat with a steel mast attempted to sail under the line, and the top of the mast made contact. There was a flash and all the Koreans jumped overboard. Two of them drowned. Suit was brought against the company. The verdict rendered by the judge is unique and unusual by American standards because it was in favor of the company.

Complainants' Korean lawyer asked for a verdict because "the lines were too low." "Not so!" retorted defendant's Korean lawyer, "the mast was too high!"

Several very modern substations along the transmission line stepped down the voltage from 132 to 22 kv, 3-phase, 60 cycle which was in turn stepped down to 3,300 v by several hundred smaller substations scattered over 40,000 square miles of territory.

There were 300,000 billed customers, an income of 50 million yen per month which at the legal rate of exchange would be a million dollars a month. However, the black market rate in 1948 was 1,000 yen to the dollar. This was only of academic interest to the Korean power companies because they could negotiate an American loan. And did so.

Many Koreans could not pay for lights and power even though their currency was worth little more than the paper it was printed on. These people became amateur linemen and would make their own service connections to their homes. To get needed wire, they would cut down a span or two where it would not interfere with *their* service. Attempts were made to disconnect this stolen load amounting to an estimated 20,000-kw demand, but were finally abandoned. No sooner would a lineman disconnect a Korean's house and disappear down the road, than the Korean householder would shin up the pole in bare feet, like a monkey climbing a tree for cocoanuts, and connect up his house again.

Many times the stolen load would cause transformer burnouts. Also, occasionally, a poorly wired house would go up in flames. But the Koreans would take such occur-

Line too low or mast too high???

* Formerly War Department operations engineer in Korea

Distribution Problems in Korea

rences in stride. They would simply move in with their neighbors next door!

The city of Pusan at the extreme southern end of the transmission line received very little power and often none at all. Power factor was 65% and voltage was invariably low. Transformers blew up like fire crackers and the Americans did too. The million Koreans living there were philosophic about the matter. But not so the Americans! They were mad about it. They had long been accustomed to the service rendered by taxpaying, business-managed power companies and demanded it, even in Korea.

Sent by the War Department as "Operations Engineer," it was up to me to do something, so I tried. When I arrived at Pusan that December day in 1947, the waterworks had shut down. Ships coming into port were unable to fill their water tanks and sailors were swapping whiskey and beer for a pitcher of drinking water. Women and children went to bed with their clothes on to keep warm, because there was no power to operate their oil burners. Warehouses were broken into after dark by Korean thieves who needed no light to steal by. The G.I. guards needed light to shoot by, and did not have any.

In order to supply minimum power requirements for Pusan, attempt was made to place in service the local steam turbine plant that had been idle for seven years. I had sixty Korean technicians and 4,000 workmen scattered from Seoul to Pusan, so I collected a large crew to work in three shifts around the clock.

The chief trouble was with interpreters. I had three. I would ask some simple question through my interpreter who would then engage in conservation with the other Koreans for five minutes. My interpreter would finally turn to me and report—"The man said No!"

We retubed boilers, replaced coal conveyor belts, packed pumps, checked instruments, circuit breakers, and generators. One generator had zero insulation resistance.

"We will have to cook it," I told a Korean engineer, Mr. Cha, through my interpreter.

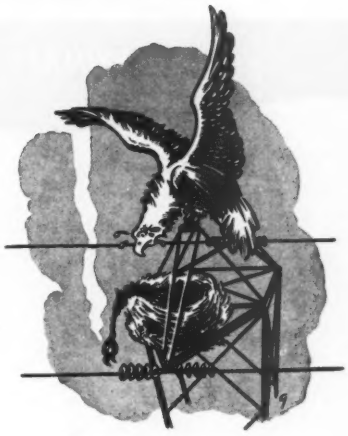
"Should we bake it or boil it?" he wanted to know.

"Boil it," I told him. It just happens that Mr. Cha was a very good engineer, and I knew it, but he was not so sure that I was. However, the answer I gave him seemed to satisfy him and encouraged him to show me that he knew his business.

The plant consisted of two 7,000-kva turbines (overload rating), B & W boilers, and Coxe stokers, or so I thought until I found the manufacturers' name plates. They were made in Japan but they were such perfect copies that even B & W or Mr. Coxe might have been fooled, just as I was. There was even a combustion control system, but I never succeeded in getting it to work.

We finally raised a head of steam, tested the plant, and placed it in service. The plant acted primarily as a synchronous condenser that released reactive power and stabilized the transmission line. Service vastly improved.

The next job was to rehabilitate the distribution lines.



Fried eagle not uncommon . . .

Many poles were so rotten at the ground that they were dangerous to climb. A survey showed the immediate need of 15,000 poles.

"Where are we going to get them?" I asked Mr. Cha.

"Telephone Company has 40,000," he told me, "but they won't sell for money. We must have something to swap."

"What do they need?" I wanted to know.

"Creosote," advised Mr. Cha.

Mr. Cha and other Koreans and I had overhauled the Pusan gas plant. We had lots of coke but very little tar and creosote.

"Swap them the tar—we keep the creosote," I told Mr. Cha, so he went off to negotiate.

Finally he returned with a contract for my acceptance. In exchange for 15,000 poles, we were to deliver 8 barrels of tar per month until the poles were paid for.

"What kind of a deal is this?" I asked Mr. Cha, but the interpreter did not bother to ask him.

"It's a Korean deal!" he said.

I needed a hole-digging machine and found that the Korean Telephone Company had three. But when I tried to borrow one, I learned that the Koreans had dismantled everything but the trucks, which the officials used to haul rice. So, we dug holes by main strength and considerable awkwardness!

Korean linemen, just like many American linemen, simply refuse to wear gloves. But unlike American linemen, they would not use hooks either. They preferred to climb a pole in bare feet!

I have seen a Korean climb a pole, stand on the roof of it, and then reach down and pull the transformer cut-outs.

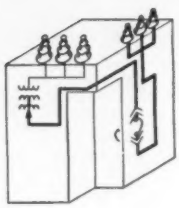
One thing they did nearly gave me heart disease. With 3,000-volt lines fallen hot to the ground, a man would dip his hands in a bucket of transformer oil and then, with bare pliers, cut the wire. We lost 30 linemen per month.

Unit Substation Application Chart

GEORGE WOOD, Substation Section, Allis-Chalmers Mfg Co, Milwaukee, Wis.

PRIMARY UNIT SUBSTATIONS

Single Circuit



Principal Use:
Utility distribution system, industrial purchasing power at transmission voltages

Practical Kva Range: 750 to 5,000

High Voltage: 4,160 to 69,000

Low Voltage: 2,400 to 15,000

Transformer: Oil immersed
Phases: Three
Cycles: 25 — 60

Circuit Breaker: Air or oil, withdrawal type, with interrupting capacity 50—500 Mva

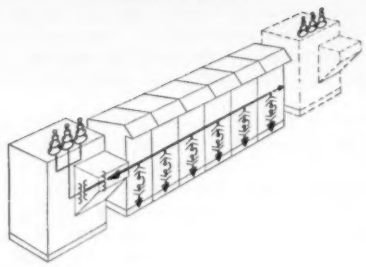
Remarks:
This type of substation is the easiest of all types of unit substation to install and put into service since the entire substation is contained in a single enclosure and mounted on a single base. Generally, all internal connections between transformer, regulator, and switchgear are made at the factory before shipment. This type of primary unit substation need only be inspected, tested if desired, purged, charged with dry nitrogen gas, and the incoming and outgoing circuits connected to put it into service.

This substation is extremely compact and an entire substation may be placed in a space less than 50% larger than that occupied by a comparable power transformer alone.

A single circuit unit substation by definition has only one feeder although additional feeders may be added in the field to some designs should load or system changes make such an alteration necessary.

Single circuit unit substations are normally used on radial systems although they may be adapted for use on some network systems.

Multi-Circuit



Principal Use:
Utility distribution systems, industrials purchasing power at higher voltages for distribution at 15 kv or below to load center unit substations, large high voltage motors or similar applications

Practical Kva Range: 750 to 30,000

High Voltage: 4,160—130,000

Low Voltage: 2,400—15,000

Transformer: Oil immersed, non-inflammable liquid (askarel), dry type
Phases: Three
Cycles: 25—60

Circuit Breakers:
Type—air or oil
Interrupting capacity—50 to 500 Mva

Continuous current rating—600 to 2,000 amp
All circuit breakers withdrawal type

Remarks:
The multiple circuit unit substation consists of a power transformer, usually with load ratio control, electrically and mechanically connected to a group of standard metal-clad switchgear. The number of feeder circuits may range from 2 to as high as 10 or 12, although 3 to 5 is the usual number. More circuits can be added by adding switchgear sections.

Multi-circuit unit substations are used on either radial or network distribution systems. The five standard types are: radial, primary network, spot network, low voltage selective, and duplex.

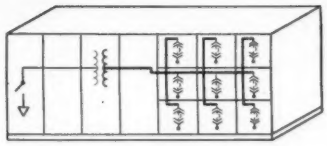
Except for duplex substations, multi-circuit units equipped with load ratio control provide bus regulation in contrast to feeder regulation of the single circuit unit. Plus and minus 10% load ratio control in 32 approximate ⅝% steps with adjustable time delay control is standard.

Outdoor design using oil-immersed transformers and weatherproof switchgear is the most widely used form of this substation for utility service. Dry-type and non-inflammable, liquid-immersed, indoor designs are often used in industrial plants.

Based on study of all types and makes of unit substations, charts on these pages offer convenient guides to the proper selection of substation components

SECONDARY UNIT SUBSTATIONS

Load Center



Principal Use:
Industrial distribution systems, medium and heavy duty

Practical Kva Range: 100—2,000

High Voltage: 2,400—15,000

Low Voltage: 120/208—600

Transformer:
Phases—One or three
Cycles—25-60
Oil, non-inflammable liquid (askarel), dry type

Circuit Breakers:

Interrupting Capacity—Amp	Continuous Rating—Amp
15,000	225
25,000	600
50,000	1,600
75,000 } Electrically operated	3,000
100,000 } only	6,000

Air-magnetic type, drawout mounted, heavy duty power class, manually or electrically operated, except as noted

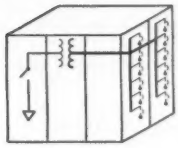
Remarks:

The load center unit substation is an indispensable ingredient of any industrial distribution based on the concept of delivering power at high voltages to an area "center of load" before it is stepped down to the utilization voltage and distributed to the point of use. Great savings in copper and installation costs as well as drastic decrease in line losses and line voltage drops with the attendant increase in motor efficiency are possible.

Load center unit substations consist of three parts: (1) An incoming line section, usually a load-break manually operated switch; (2) one or two power transformers (dry type is most popular for indoor, oil-immersed for outdoor installation); and (3) a distribution section composed of metal-enclosed switchgear and breakers stacked one, two, three, or four high.

To conserve valuable floor space, dry-type, load-center unit substations may be mounted on balconies inside the load areas or on the load areas or on the roof. Water-cooled, non-inflammable, oil-immersed transformers may be located in areas of restricted or limited air circulation. Hermetically-sealed, dry-type transformers are entering the field.

Distribution Center



Principal Use:
Industrial distribution, lighting and small power systems

Practical Kva Range: 75—300

High Voltage: 2,400—15,000

Low Voltage: 120/208—600

Transformer:
Oil, non-inflammable liquid (askarel), dry type
Phases: one or three
Cycles: 60

Circuit Breakers:
25,000-amp interrupting capacity maximum, thermal-magnetic type, fixed mounted, light duty, manually operated only

Remarks:

Many load center applications are too small and have duty too light to economically warrant a heavy duty load center unit substation. Lighting and small motor loads, 300 kva or less, where the circuit breakers are used principally for switching rather than for protective duty, are examples of such an application. Such a load can often be adequately served by a distribution center unit substation which consists of a manually operated switch, a small load center transformer, and a bank of plastic-cased thermal breakers.

A distribution center unit substation mounts the thermal breakers in a hinged panel mounted on an end of the transformer which is an indoor dry-type. Thermal breakers are small. The average size is about that of a cigar box, so 20 or 30 may usually be mounted in one substation with ease. They are relatively inexpensive and the usual number per transformer kva runs 6 to 10 times that of other breaker types.

Distribution center unit substations are recommended for light duty only and sizes above 300 kva are not recommended. Secondary connections between units are not recommended.

For a condensed table giving rating data on standard load center unit substations, please turn the page

Standard Load Center Unit Substation — Condensed Data Chart

Standard load center unit substations have three main sections—incoming lines, transformers and switchgear. Tables below offer condensed data to guide in selection of equipment for each section

TABLE I — INCOMING LINE SECTION

1. Cover bushings
(Cover bushings obtainable on all types of transformers.)

2. Terminal box
(Terminal box with cable lugs obtainable on all types and sizes of transformers.)

3. Oil fused cutouts
(Oil fused cutouts limited to transformers 375 kva and below, at 2,400, 4,800 v, 500 kva and below at 4,160 v.)

4. Primary switch
a. Load break
b. Magnetizing current break only
(Primary switches available on all transformers. Load break switches available up to 1,000 kva at 2,400 v, 1,500 kva at 4,160 and 4,800 v, 2,000 kva at 7,200 12,000, 12,470, 13,200 and 14,400 v. Magnetizing current break switches must be interlocked with main or feeder breaker.)

5. Metal-clad switchgear
(Metal-clad switchgear available on all transformer types and sizes.)

TABLE II — TRANSFORMER SECTION

Std. Primary Voltages	Std. Primary Taps 2-2½% F.C. Below	Above	Kva Ratings Self Cooled	Forced Air Cooled[1]	Std. Secondary Voltages[2]
2,400	.....	2,520	100	Not Recommended	1. 208/120 4 wire
	.....	2,460	150		2. 240 3 wire
	2,340	.....	200		
	2,280	.....	300		3. 480 3 wire
4,160	.....	4,368	500	625	
	.....	4,264	750	937	
	4,056	.....	1,000	1,250	4. 600 3 wire
	3,952	.....	1,500	1,875	
			2,000	2,400	5. 480/277 4 wire
4,800	.....	5,040	Transformer Types		
	.....	4,920			
	4,680	.....			
	4,560	.....			
6,900	.....	7,246	Air-Immersed		Liquid-Immersed[3]
	.....	7,073			
	6,727	.....	1. Dry type, 80C rise Class "B" insulation.		1. Oil-immersed 50C rise Class "A" insulation.
	6,554	.....			
7,200	.....	7,560	2. Dry type, hermetically sealed. Class "H".		2. Non-inflammable liquid-immersed (askarel) 55C rise Class "A" insulation.
	.....	7,280			
	7,020	.....			
	6,840	.....			
12,470	.....	13,092			
	.....	12,781			
	12,159	.....			
	11,848	.....			
13,200	.....	13,860			
	.....	13,530			
	12,870	.....			
	12,540	.....			
14,400	.....	15,120			
	.....	14,760			
	12,870	.....			
	12,540	.....			

NOTES:
1. Forced air cooling not recommended below 500 kva because it is more economical to get additional kva capacity by purchasing the next largest std. size transformer.
2. Items 1 and 2: Lighting, small motors.
   Items 3 and 4: Heavy duty, low voltage motors.
   Item 5: Combination heavy duty power and fluorescent lights.
3. Oil-immersed transformers can be used indoors only in a fireproof vault. All others used indoors or outdoors.

TABLE III — SWITCHGEAR SECTION

A. Standard Low-voltage metal-enclosed switchgear, with

Power Class Circuit Breakers[2]

Circuit breakers are drawout mounted

Ratings

Amperes: AIC	Max. CCR	Trip
15,000	225	10–225
25,000	600	35–600
50,000	1,600	200–1,600
75,000	3,000	2,000–3,000
100,000	6,000	4,000–6,000

Voltages: 600 v only

Operation: All manually or electrically except 75,000 and 100,000 AIC which must be electrically operated because of size.

Trip Types Available:[3]
Time delay
Instantaneous
Thermal
Dual-magnetic

NOTES:
1. Metal-enclosed switchgear with drawout mounted power class circuit breakers for heavy duty feeder protection.
2. Shunt trip voltages:

DC	AC
24	....
48	110
125	220
250	....

(AIC = Amperes interrupting capacity)
(CCR = Continuous current rating)

B. Sheet-metal Enclosure with

Molded-Case Thermal Breakers[1]

Thermal breakers are fixed mounted

Ratings

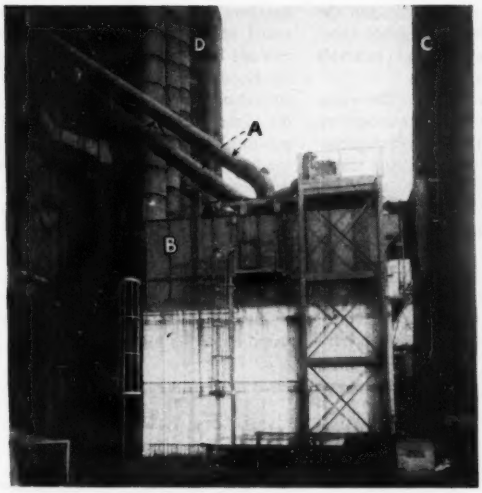
Amperes:
25,000 AIC Max.:
Continuous current rating of 15, 20, 30, 40, 50, 70, 100, 125, 150, 175, 200, 225, 250, 275, 300, 350, 400, 450, 500, or 600 amp.

Voltages: 250 to 600 v

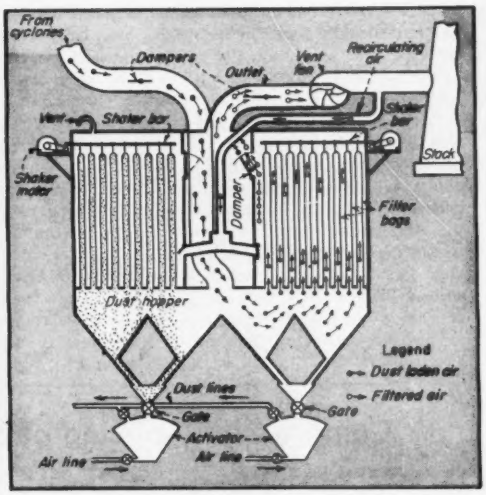
Operation: Manual operation only.

Trip available:
Thermal-magnetic

NOTES:
1. Plastic case thermal breakers not recommended for use with transformers larger than 300 kva or for other than primarily switching duty.



BAG FILTER installed at rear of pulverizer mill house (left) at Consolidated Edison's East River generating station. (A) air vents from mills to filters. (B) filter compartment building. (C) stock. (D) former spray towers



DUST-LADEN AIR from pulverizer mills and cyclone separators is passed through bag filter where coal fine is trapped and blown to fuel bins. Two compartments are shown. While shaker bars work, each compartment is closed to air flow

Bag Filter System Saves 25 Tons Of Coal Dust Per Day

Housing developments prompt installation of million dollar filter system to relieve annoyance of coal fines in the air. Filter compartments protected against fire by carbon dioxide and saturated steam sprays

AN oversize vacuum cleaner traps coal dust entrained in the vents of six coal pulverizing mills at East River generating station of Consolidated Edison Co of New York, Inc.

Bag filters were placed in operation a couple of years ago at a cost of slightly over $1,000,000. It is estimated that, through their action, approximately 25 tons of coal dust a day are salvaged and fed into the station boilers.

Original Installation . . . East River station, one of the first all-pulverized fuel plants of its size, was built in 1926. Here four roller mills can deliver 40 tons per hour each and two can handle 25 tons per hour each. Originally each mill was vented through one cyclone separator which removed about 99% of the pulverized coal from the air. A second cyclone with a skimmer tail known as a concentrator removed half of the fine particles remaining in the air. Then the vented air passed through a spray tower and to atmosphere.

Water and coal dust draining from the spray tower collected in a sump tank and was processed to a concentrated slurry. Pumped to the boiler house, the slurry passed through an atomizer into one or more of the boiler furnaces where the coal burned and the water was evaporated. This was primarily a means of disposal, as the heat content of the slurry was just about sufficient to evaporate the water.

Housing Springs Up . . . But the character of the neighborhood around East River station changed with the construction of several large housing developments, including Peter Cooper Village, Stuyvesant Town, and the Jacob Riis housing development. When high venting rates were required to dry wet coal (fans on the large mills each have a capacity of 26,000 cfm and on the small mills 16,000 cfm), the fines carried through the spray caused a neighborhood annoyance.

Bag Filters Are Installed . . . To avoid this, a bag filter system was installed. After passing the first cyclone separator the vents from each mill are carried down to a separate structure where the bag filters are located. By

by-passing the second cyclone a material reduction in back pressure was achieved and coal formerly caught by this cyclone and the sprayers is now trapped in the bag filters.

Each vent is run through four parallel compartments where vertical canvas bags trap the dust. Through an automatic timing device each compartment is shut off in turn. When the compartment is out of the air stream the bars on which the canvas bags are hung are mechanically shaken. Trapped dust falls into hoppers below and is blown by activators to the pulverized fuel bins at the boilers. The lines which transport the dust have permanently attached compressed air connections at intervals for use in case of clogging.

Cleaned air coming from the compartments is passed to the atmosphere through a 300-ft stack. On each group of four compartments serving a single mill is a 75-hp motor-driven fan which more than compensates for the pressure drop in the ducts and bag filters.

In Case Of Fire . . . Thermocouples detect unsafe temperatures, either in the bag filter compartments or the coal hoppers. If such temperatures occur, dampers are closed at the inlet and outlet of the filter, the fans and the mill are halted, and the compartments are flooded with carbon dioxide. To determine if a fire is still burning after the carbon dioxide flooding, the temperature inside the compartment is checked on a dial thermometer. This thermometer has its bulb inside the compartment and its indicating element on the exterior of the structure adjacent to a saturated steam hand valve. This valve is opened to steam blanket the fire if necessary. Operation of the bag filter is interlocked with operation of its associated mill.

Compression Splicing of Span Wires Cuts Cost 70%

NEW GUY WIRE LENGTH, 3 ft long, being attached to the compression sleeve has both ends smeared with corrosion inhibiting grease prior to insertion in the sleeve

COME-ALONG and hoist are here in position, and strain has been relieved near the insulator. Crew is cutting 2½ ft out of span wire starting from left side of damaged insulator

S. M. SHOCKEY
Overhead Superintendent
Seattle Transit System

and

MORRIS BRENNER
Asst Technical Service Engineer
Burndy Engineering Co, Inc
New York, N. Y.

Use of compression sleeves for replacing corroded guy wires is saving Seattle Transit System almost 70% as compared with costs of repairing by conventional fan splicing. This saving is brought about largely through labor savings in reducing time per splice from 20 minutes to 3 minutes. A boon to the company's Traffic Dept is the minimizing of traffic tie-up time.

Need for replacement or repair of the overhead guy wire is primarily due to corrosion failure of that portion of the wire which passes through the johnny-ball insulator. Moisture and dirt collecting in the insulator cause corrosion of the strands. External damage caused by a truck or trolley must also be reckoned with.

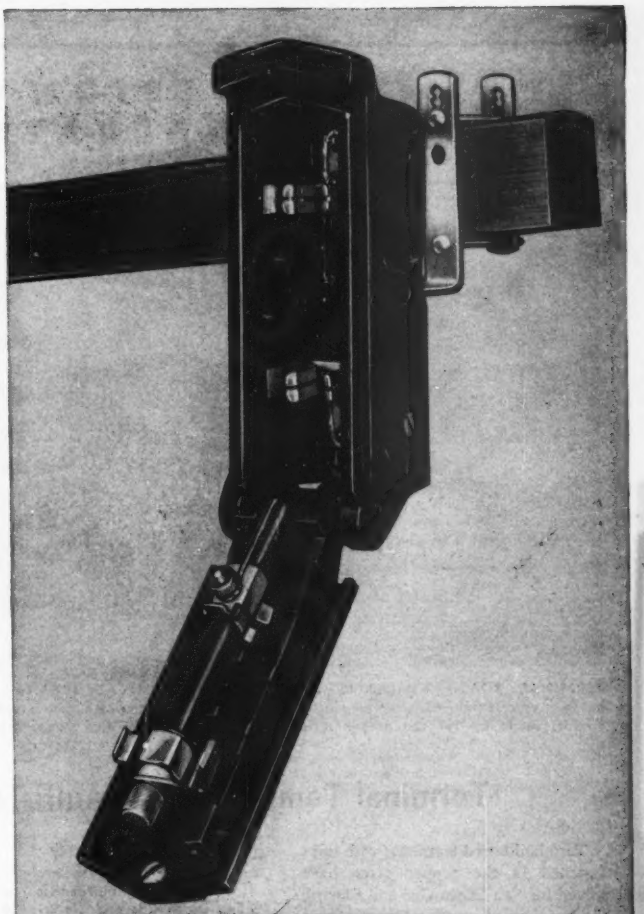
Corroded wires are now replaced with a three-foot length of new wire. This wire is spliced to the end of the existing span wire with a compression sleeve. Corrosion inhibiting grease is smeared on both new and existing guy wires before splicing. A single four-indentation die is used on each end of the sleeve. Total splicing time averages three minutes. On "slow" days, one side of the splice can be made up in the shop for application in the field at a later date—further reducing installation time. Pull tests have proved the splice more than adequate for the 1,150-lb maximum tension encountered on the span wire in service.

For fusing and disconnecting, this is the most cutout for your dollar

This G-E nonindicating fuse cutout is the most reliable of all porcelain enclosed types. It costs less to maintain. With practically no moving parts, it is the sturdiest cutout built. And you stock fewer replacement parts since all contacts, fuse holders, and other items are interchangeable with G-E cutouts manufactured during the last 24 years.

So—unless you have banked secondaries or other conditions that make indication necessary—this is the cutout to use. It's the lowest-cost all-round cutout providing for fuse holder or disconnecting blade.

Stocked in 50- and 100-ampere sizes, in both 5.2 kv and 7.8 kv ratings. For details contact your G-E Apparatus Office. *Apparatus Department, General Electric Co., Schenectady 5, New York.*



compare it . . .

MECHANICALLY—**Housing is of wet-process porcelain glazed inside and out. Door is of Textolite*. Double interlocking barriers between contacts. Hanger cemented to housing permits vertical, tilted and swivel positioning.**

ELECTRICALLY—**Generous size of contacts, which are self-aligning, provides liberal contact area. All contacts are silver-plated.**

FUNCTIONALLY—**Provides positive full-range current interruption. Fuse holder is isolated from contacts in housing when door is open. Fuse holder (or disconnecting blade) cannot be placed in cutout door incorrectly. Permits easy and quick replacement of blown fuse.**

*Reg. Trade-mark General Electric Company

GENERAL ELECTRIC

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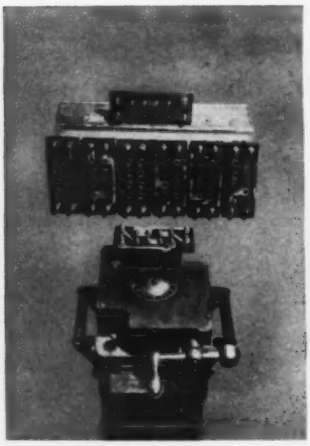
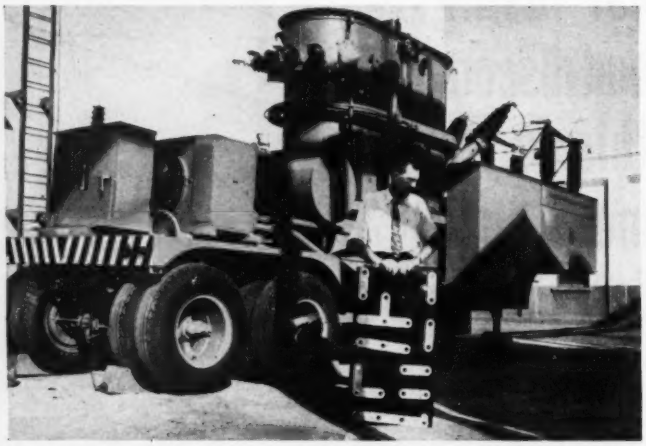
HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



TERMINAL BOARD TEMPLATES are made of copper links fastened on plastic boards, made up for the proper ratio



EXTENDING TEMPLATE IDEA to a 6,000-kva mobile substation, copper links are fastened loosely on plastic board split so it will go through manhole on transformer cover. The boards are doweled so that they will not be put on backwards

Terminal Templates for Multi-Tap Transformers

R. D. ALEXANDER
JOHN CAME
Electrical Maintenance
San Diego Gas and Electric Co

Terminal board templates with links fastened in the proper place have solved for San Diego Gas and Electric the bugaboo of wrong connections on multi-tap transformers designed for several different voltage ratios. For some time the company has been using the scheme with 120/240-v variable voltage regulators, as shown.

Now terminal board templates will be used to make the proper transformer connections in a 6,000-kva trailer-mounted substation. Two sets of templates will serve to give voltage ratios of either 66,000/4,330 or 66,000/12,470 v.

The templates are made of Bakelite with copper links fastened loosely in the proper positions. The boards are split lengthwise so they will fit through the small manhole on top of the transformer tank, and are doweled to prevent their being connected while reversed should they be turned around as they are put in the tank. Not only do the templates prevent any errors in connecting the transformer taps under oil—they also eliminate the possibility of dropping any links into the tank while the connections are being made. Result is a fast, convenient, and sure method of changing the voltage ratio under the most adverse conditions of poor visibility or weather.

Is It Necessary to Retighten Clamp Connectors?

I. MATTHYSSE
Chief Design Engineer
Burndy Engineering Co
New York, N. Y.

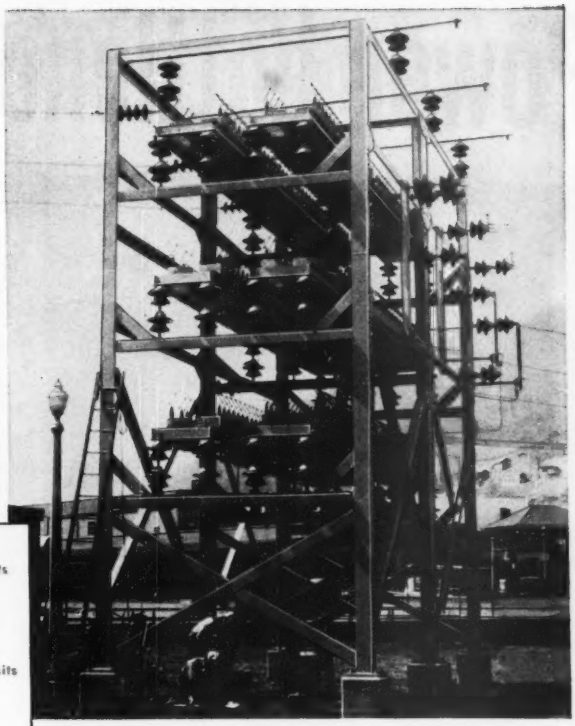
Does periodic retightening of clamp-type electrical connectors really help maintain cool operation of the joints? That cool operation of joints can usually be expected without any maintenance is one of the conclusions reached as a result of recently conducted tests. This series of simple tests was intended to determine the effect on the joint efficiency of relaxing clamping pressure.

For one test series, eight regular clamp-type terminals having four ⅜ in. silicon bronze clamping bolts were connected in series in a loop of 500-Mcm aluminum cable. The bolts were initially tightened to 300-in.-lb torque. Bolts of four of these connectors were not retightened throughout the test. However, the bolts of the second group of four connectors

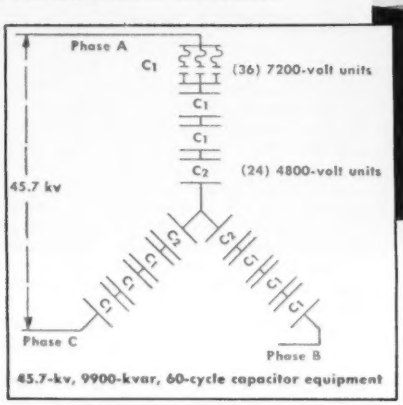
(*Continued on page* 114)

Capacitors now in use for 23 kv and above

Open-type equipments, for voltages up to 230 kv, consist of 25-kvar outdoor units connected in series-parallel, and mounted on insulators in galvanized-steel structures.



This 9900-kvar General Electric capacitor equipment, operating at 45.7 kv, 3-phase, has recently been installed in West Virginia. It consists of 396 individual 25-kvar outdoor capacitors, connected as shown in the diagram below.



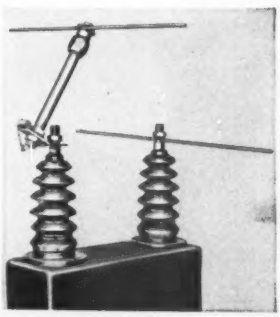
45.7-kv, 9900-kvar, 60-cycle capacitor equipment

This connection diagram applies to the capacitor equipment pictured above.

General Electric is now in a position to furnish capacitor equipments for all transmission-circuit voltages (equipments have already been furnished rated as high as 124 kv). These equipments are used on high-voltage circuits to supply bulk kilovars and thus re-enforce the sub-transmission voltages and also reduce thermal loading of substations and generators.

The capacitors used in these equipments are General Electric, outdoor 25-kvar units, rated 2400- to 7960-volts, depending on the circuit voltage. Units are connected in series-parallel to attain the desired voltage and kvar ratings. Individual bushing-mounted fuses are supplied for each unit.

For full information, get in touch with your G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.



The bushing-mounted fuses, shown here and used with each capacitor in high-voltage equipments, are of the indicating type.

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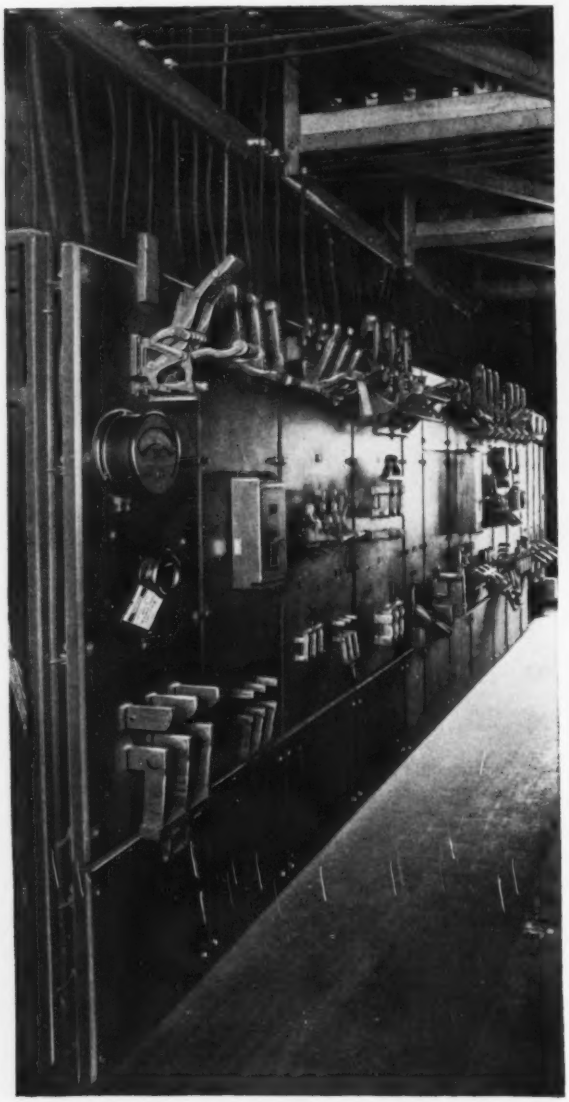
GENERAL ELECTRIC

Power bottleneck broken



This is the old open-type switchgear originally installed at the Traylor Engineering & Manufacturing Co. Exposed switches were a safety hazard. With extra feeders added through the years to take care of expansion, the rear of the switchboard had become a tangle of cables, inviting short circuits. Old 240-volt distribution system seriously limited future expansion.

New G-E Metal-Clad switchgear provides for increased output, gives greater safety

Old equipment was inadequate for growing needs

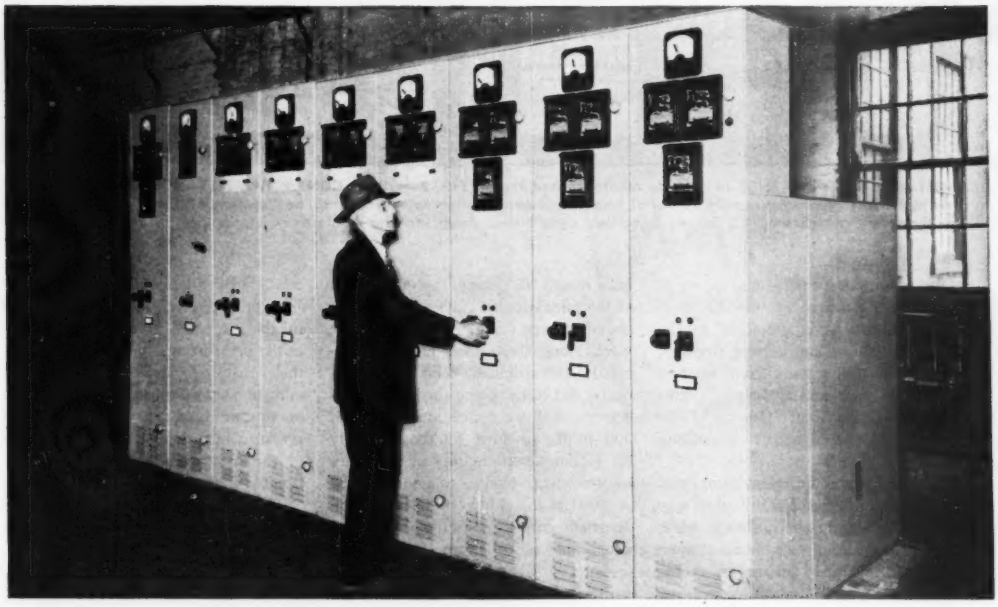
After years of service at the Traylor Engineering & Manufacturing Co., Allentown, Pa., the old-fashioned switchgear shown at left was operating on borrowed time. Already over-loaded through increasing power demands, it had become a bottleneck that limited expansion and hampered efficient production.

With interrupting devices entirely inadequate to handle the power that could be delivered under short-circuit conditions, any major fault in the system could have been disastrous.

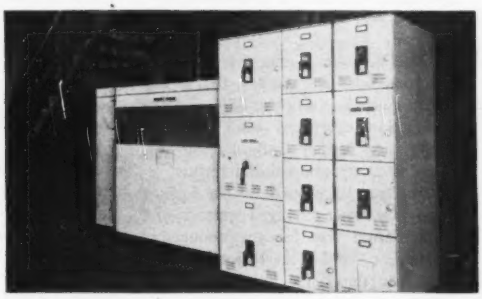
Today this obsolete equipment has been replaced by modern G-E metal-clad switchgear. Dangerous exposed switches have vanished. Interrupting capacity is adequate to take care of abnormal conditions. And a modern high-voltage distribution system assures ample power for years to come. See opposite page.

For information on similar equipment for your plant, contact your G-E sales representative—or write for Bulletins GEA-3083 Metal-clad Switchgear; GEA-3592 Load-center Unit Substations; GEA-3758 Load-center Power Distribution. *General Electric Company, Schenectady 5, N. Y.*

at this Eastern Plant



Modern G-E Metal-clad Switchgear now installed at the Traylor Company provides greater safety because all parts are completely enclosed. For greater protection against short circuits, separate circuits are isolated in individual compartments. Circuit breakers may be easily removed for inspection, with protection for personnel. Power is distributed from this unit at 2400 volts, replacing the old 240-volt distribution system.



Load-center Unit Substation eliminates long low-voltage feeders—saves copper. 2400-volt power is received at this load-center unit substation and stepped down to utilization voltage on the factory floor. Because the substation is located close to the machines it serves, low-voltage feeders are short, saving copper and giving better voltage control. Discarded cable previously used for low-voltage distribution is shown at left.

GENERAL ELECTRIC

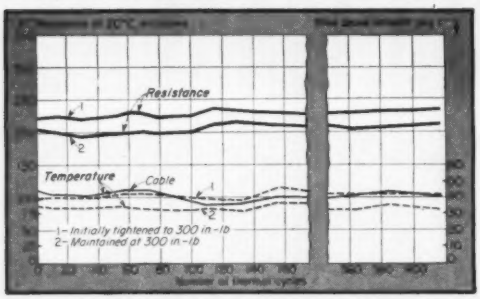


FIG 1—SMALL DIFFERENCE in average resistance and temperature rise for connectors held at initial torque, compared to those not retightened, is of no practical significance

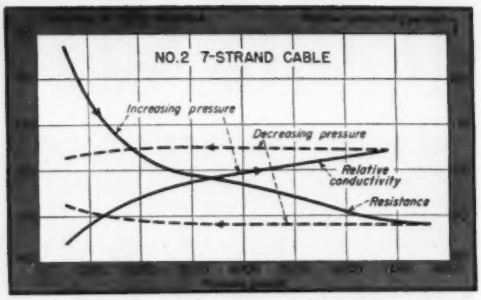


FIG 2—GOOD CONTACT RESISTANCE made upon initial tightening seems to be "sealed-in." Lessening pressure did not increase contact resistance nor decrease conductivity

were retightened every day or so to maintain the torque at 300 in.-lb.

Connectors were subjected to the alternate heating and cooling imposed by applying full rated current for two hours and then cooling to room temperature in one hour. This cycle was repeated 417 times before concluding the test.

To exaggerate the effect of relaxation, the conductor in this test was 500-Mcm aluminum building wire, and the connectors were of cast copper alloy, hot-dip tinned for use on aluminum. It was felt that differences in the temperature coefficient of expansion of the dissimilar metals would cause cyclic stress changes, thereby accelerating relaxation of pressure. To exaggerate the effect further, no compound was used on the contact surfaces.

The first few times that the connectors were retightened the torque had fallen off as much as 25%. Torque relaxation decreased until after 13 days no further retightening was needed to maintain initial torque.

Test results plotted in Fig 1 show a slightly lower average resistance and temperature rise for the connectors maintained at 300 in.-lb torque compared to those not retightened. But the small difference is of no significance since at least that much difference can always be found among any two identical connectors. However, the significant fact is that there was practically no change of resistance or temperature rise of either set of connectors over the entire 417 cycles of testing. The very slight rise of resistance is present to the same extent in both sets.

In spite of the test set-up which was meant to exaggerate the effect of the relaxation of clamping pressure, no effect was found. More extensive work along these lines may be indicated. Nevertheless, relaxation obviously did take place in those connectors that were not maintained at 300 in.-lb, as seen by the necessity for repeated retightening of the other set on which torque was maintained at 300 in.-lb. Thus the explanation for stable contact resistance in spite of relaxation of pressure had to be sought.

Fig 2 shows the results of a test on the contact resistance of two No. 2 seven-strand copper conductors in overlapping contact. The resistance was measured over 12 in. and the relative conductivity was based on an equal length of the conductor alone. Note that as the pressure between conductors increased the resistance dropped and the conductivity increased in the expected manner. However, as the pressure was gradually released, the resistance and conductivity remained at the values they attained at maximum pressure. Not until the pressure had dropped to about 25% of the maximum was there any noticeable increase of contact resistance.

This indicates that the good contact resistance made upon initial tightening is, in a manner of speaking, "sealed-in" so that it is maintained, even though the pressure relaxes appreciably. Apparently the increasing pressure brings more and more points into contact, flattening and spreading these points into greater contact areas. These numerous areas remain in good electrical contact until the pressure is very greatly reduced.

Opposite-Lay Conductors Weaken Splice

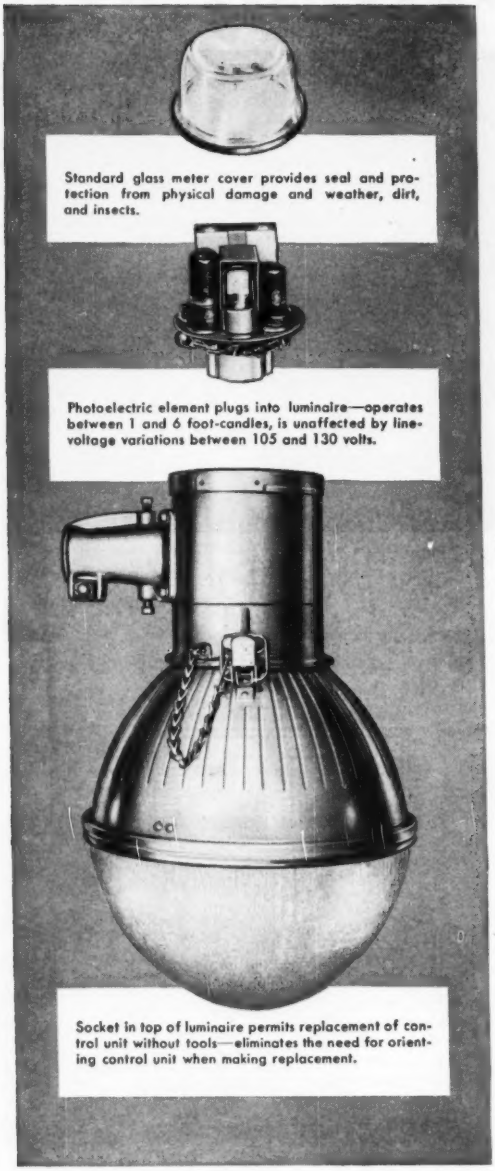
When overhead line conductors of opposite lay are spliced together, the difference in lay will decrease the maximum strength of the connection. This report is based on tensile tests carried out by an eastern utility on a splice of 4/0, 7-strand, HDB, opposite-lay copper conductors with a breaking strength of 9,150 lb.

When a sample connection of opposite-lay conductors was placed under partial load, the splice itself began to rotate slowly. Further tension was applied until failure occurred at 8,485 lb in the left-hand lay. It was assumed that the unwinding of the lay allowed too much stress to be applied to the core strand, causing it to break. The remaining six outside strands could not withstand the resulting load and they broke also.

The splice itself showed no evidence of distress, and another sample of the left-hand lay conductor was tested to failure at 9,220 lb. Thus, neither the splice nor the conductor contributed to the failure.

Much of this company's old plant was built before manufacturers standardized on cable with left-hand lay. It has been suggested to operating and construction divisions that the proper lay be used to match conductor on the old plant. A small but reasonable amount of right-hand lay conductor will be reclaimed for this use.

For Outlying Areas using multiple circuits


Standard glass meter cover provides seal and protection from physical damage and weather, dirt, and insects.
Photoelectric element plugs into luminaire—operates between 1 and 6 foot-candles, is unaffected by line-voltage variations between 105 and 130 volts.
Socket in top of luminaire permits replacement of control unit without tools—eliminates the need for orienting control unit when making replacement.

Photoelectric Luminaire Form 110

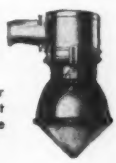
The Form 110 luminaire is the simplest way of controlling street lighting from multiple circuits. It is especially suitable for isolated installations beyond the reach of existing street-lighting circuits. Safety and adequate lighting are thereby provided where more extensive facilities could not be justified.

In the General Electric Form 110 luminaire, you have one compact, easy-to-install, easy-to-maintain unit. The Form 110 luminaire is operated by a photoelectric relay containing a sensitive phototube, two amplifier tubes for high amplification, and a tough load relay. All elements of this unit operate well below rated values for extra-long service.

After power failure the G-E Form 110 luminaire continues to operate the way you set it—and it's good for years of operation without adjustments. If it should fail, the control unit turns the luminaire ON, not OFF.

For a new idea in savings, look into the G-E Form 110 luminaire. Contact your nearest G-E office, or write for Bulletin GEC-395, General Electric Co., Schenectady 5, N. Y.

Type P Photoelectric Control for pole or cross-arm mounting.

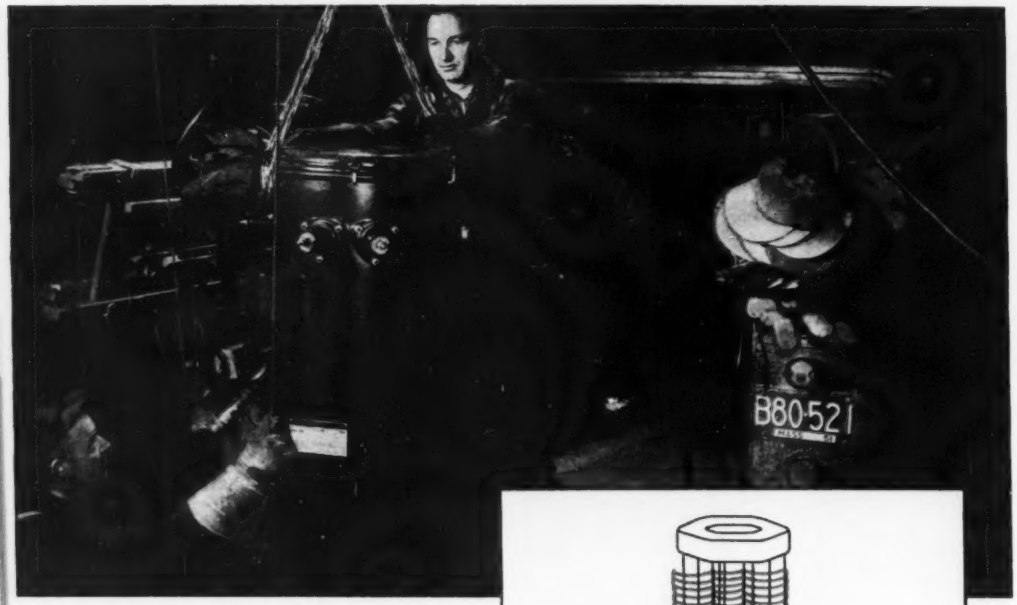


Reflector support for Types CR or CS optical assemblies is die-cast aluminum, clamped to lugs on the hood.

GENERAL ELECTRIC

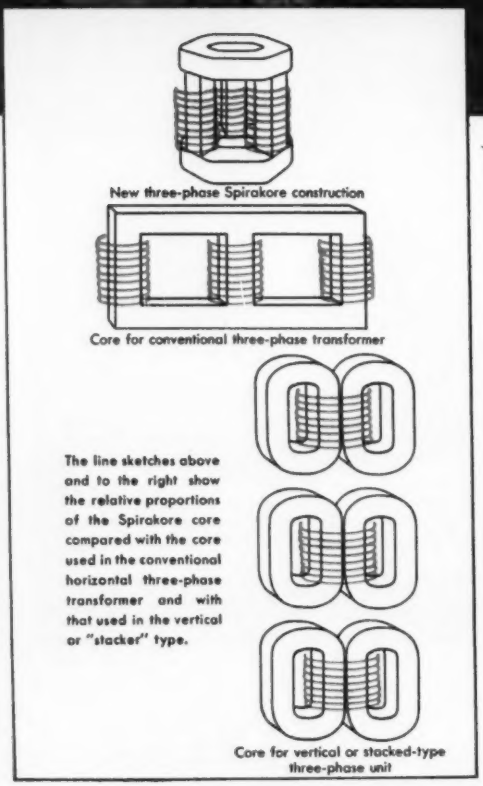
452-116

Now-a radically new



New three-phase Spirakore distribution transformers are easier to handle. The 45-kva unit is 400 pounds lighter than conventional designs, and takes 21% less platform space. Its height is 17 inches less than the vertical or "stacker" type.

This is a typical core of General Electric's new Spirakore three-phase distribution transformer. The core steel is "corosil"—cold-rolled silicon strip with the grain structure of the steel oriented with the flux path.



New three-phase Spirakore construction

Core for conventional three-phase transformer

The line sketches above and to the right show the relative proportions of the Spirakore core compared with the core used in the conventional horizontal three-phase transformer and with that used in the vertical or "stacker" type.

Core for vertical or stacked-type three-phase unit

SPIRAKORE three-phase distribution transformer

Revolutionary General Electric design cuts weight 25% over conventional units

New transformer uses cold-rolled oriented steel in wound-core construction for the first time in a three-phase core. Improvements include smaller dimensions, easier handling, and lower exciting current. This transformer is suitable for *either* pole or floor mounting.

General Electric is now building three-phase distribution transformers up to 150-kva, 15,000 volts and below, with Spirakore construction. This is the result of intensive research—another advancement by the company that first introduced wound-core construction to distribution transformers in 1937.

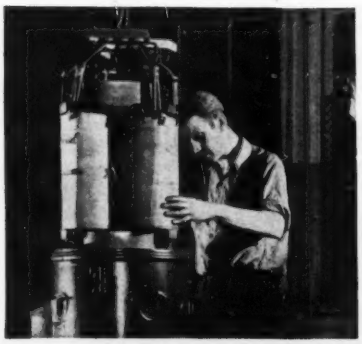
These new three-phase transformers have lighter weight, smaller dimensions and lower exciting current.

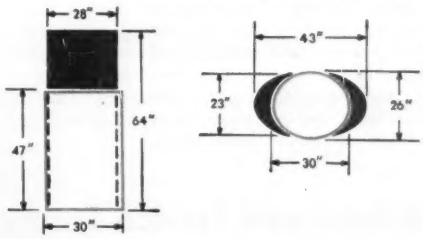
All the other improvements that have characterized Spirakore are incorporated—high mechanical strength, excellent impulse strength, completely sealed tanks, and superior Melaglyp† paint that is 50% better in resistance to weathering and moisture absorption.

For full information on these transformers, contact your nearest G.E. Apparatus Sales Office, or write *General Electric Company, Schenectady 5, New York.*

* Reg. Trademark of General Electric Company.
† A new, greatly improved G-E paint made with melamine-modified Glyptal (registered trademark of the General Electric Company for alkyd resin).

Here the core-and-coils of a 30-kva Spirakore three-phase transformer are being lowered into the tank.





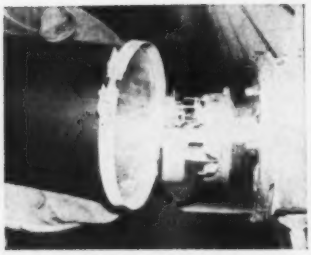
These two diagrams compare the height of the new three-phase transformer, in red, with that of a vertical or "stacker" three-phase unit, in black—and the floor area with that of a conventional or horizontal three-phase transformer. In both cases transformers are rated 45 kva.

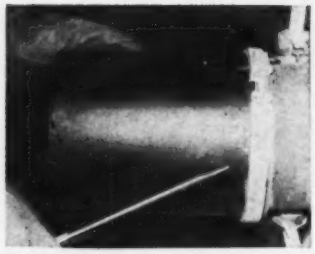
THREE-PHASE SPIRAKORE TRANSFORMERS 9-150 KVA, 5000 VOLTS AND BELOW

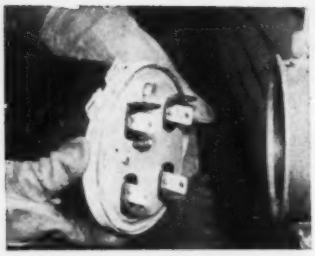
	9 Kva	15 Kva	30 Kva	45 Kva	75 Kva	112½ Kva	150 Kva
Net Wt Inc. Liquid	390	510	900	1000	1400	2100	2450
Height	29	39	47	47	57	63	70
Floor Space	24x23	24x23	28x26	30x26	33x29	36x34	36x34
Liquid (gal)	16½	20	39	37	62	87	92

GENERAL ELECTRIC

402-107







BROKEN COVER is removed safely with special holder. After removing seal ring from meter, place holder over meter with clamp ring over meter-cover ring (left); tighten screw to clamp meter-cover ring (center); remove meter as usual (right)

Modified Can Removes Broken Meter Covers Safely

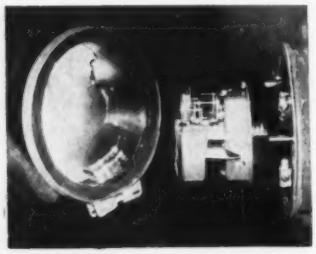
WILLIAM F. BLACK
District Meter Superintendent

EDMUND HOLCOMB
Meterman
Indiana & Michigan Electric Co
South Bend, Ind.

To avoid personal hazard in handling broken glass meter covers a simple and inexpensive device can be made from a discarded can previously used to hold anti-freeze solution.

This converted can will slip over and clamp onto all types of outdoor glass-cover socket-type meters, including the thermal-demand kilowatt-hour types. It is made from a one-gallon round can having the necessary diameter and depth. Such a metal device eliminates dangers involved in taking off jagged broken covers more than do canvas or leather bags.

Open end of the can is equipped with a copper, screw-clamp, meter-sealing ring, one flange of which clamps back of the beaded edge of the can. The other flange was previously rolled over to the inside with a ball-peen hammer. End of the can is cut out with the type of can-opener which removes the end but retains the edge.



LAST STEP is to detach meter assembly and replace in socket. Broken glass cover remains clamped in holder.

Procedure for removing a broken-cover is illustrated. Final step is to clean the meter, equip it with a new cover and test.

Consideration was given to the use of canvas or leather bags which could be clamped over the broken cover while meters were being removed. However, this method was discarded because glass splinters lodged in the material of the bags and added another hazard. Also, exposed metal parts could be damaged.

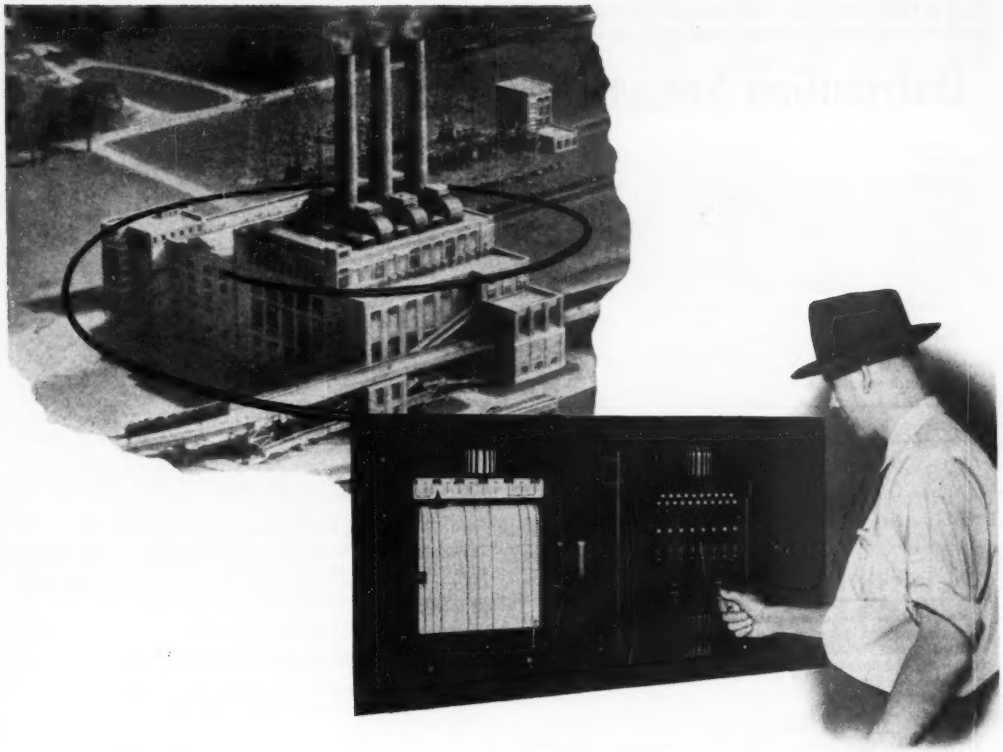
For safety, leather gloves are worn while installing or removing meter covers, even with this device, since glass breakage may result from strains or temperature changes.

When installing glass-covered meters good practice dictates that the meters should not be forced into their sockets by thumping them with the hand. They'll slide into place easier if a thin film of petroleum jelly is applied to the terminal blades and jaws. Excess jelly will be removed and proper electrical contact assured by the wiping action of the blades on the jaws when the meter is put in place.

Well-Equipped Service Trucks Replace Pick-ups

SPECIAL PROVISION for carrying tool boxes and other equipment has caused Los Angeles Dept of Water and Power to replace standard pickups with light-duty transmission line patrol and service trucks like this. Five men ride in converted cab

VERTICAL CAPSTAN is used for hoisting insulator strings. Other equipment for the four-wheel-drive rig includes a forward winch with fairlead, vise, rope hooks, water bags for desert patrols. Rack on top carries ladders and hotstick box



Round Up 160 Plant Temperatures—Every 10.7 Minutes

Every power plant has hundreds of bearing temperatures—in generators, motors, fans, pumps, exciters—which need constant watching in order to protect equipment and guard against shutdowns. Because these points may be widely separated, manual temperature checks may not be made frequently enough to insure complete protection. With the Multi-Bank Speedomax Recorder, however, a large number of temperatures can be concentrated on a single instrument, and supervision of all critical bearings can be brought to a central point with other plant controls.

160 Points on One Instrument

This Speedomax records a maximum of 160 separate thermocouple temperatures, at a speed of four seconds per point. It scans through all 160 points in less than 11 minutes—a rate that is amply fast to reveal indications of trouble before overheating can become serious.

Gets Data Economically

Where a large number of points are required, this model provides L&N quality recording at lowest cost per point. In crowded control rooms, it saves panel space by concentrating an exceptionally large number of points on a single instrument.

Choice of Operating Functions

The instrument monitors each point in succession, either recording or not as desired. If any temperature gets too high, the Speedomax automatically starts recording all points, and operates an alarm. When the operator starts trouble shooting, he can concentrate the measurements on a desired point or group of points.

Bearing Temperature Detector

In checking bearing temperatures, detection is by a specially designed high-speed thermocouple. Enclosed in a thin, flexible tube, the couple can be mounted easily in bearing metal or oil lines.

For further information, write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

Jrnl Ad ND46-33-461(1)

LEEDS NORTHRUP

Distribution Secondaries' Voltage Drop, Line Loss

Calculation procedure is outlined for both concentrated and uniformly distributed load conditions. This is an adaptation from engineering data of a middle western utility.

VOLTAGE DROP

Condition I—Concentrated Load

Distribution line data are:

Load, kw	10
Power factor (cos θ), %	90
Voltage (120 to neutral)	240
Amperes (per "hot" wire when balanced) (kw × 1000)/(E cos θ)	46
Distance, transformer to load, ft	500
Size "hot" wires, H. D. copper, stranded	No. 2
Size neutral, H. D. copper, solid	No. 4
Conductor spacing, in	8

Wire Data and Load Unbalance

Wire Size	Ohms, 500 ft		Ampere for Unbalance of				
	R	X	Wire	0%	20%	50%	100%
2	0.0829	0.0495	No. 1	46	50	55	61
			No. 2	46	42	37	31
			Total	92	92	92	92
4	0.1292	0.0528	Neutral	0	8	18	30

Percent Load Unbalance is defined as the percent load increase in heavier loaded hot wire over the lighter loaded hot wire. The neutral carries the difference. If the total of 92 amp, as above, is known, the individual wire loads may be found, using a 50% unbalance, as follows:

$X + 150\% X = 92$

$X + 1.5X = 92$, $2.5X = 92$

$X = 37$, $1.5X = 55$, Difference is 18

Note: Allowable voltage drops from transformer to end of secondary are:

Urban; $3\% = 120 \times 0.03 = 3.6$ v

Rural; $4\% = 120 \times 0.04 = 4.8$ v

With load, power factor, conductor spacing and conductor impedance known, voltage drop may be calculated from the equation:

$e = I (R \cos \theta + \sin \theta)$

where e = voltage drop
I = current, amp
R = resistance, ohms
X = inductive reactance, ohms
cos θ = cosine of power factor
sin θ = sine of power factor

Voltage Drop $= e = I (R \cos \theta + X \sin \theta)$

For No. 2 cu $= I (0.0829 \times 0.9 + 0.0495 \times 0.4357)$
$= I \times 0.0962$

For No. 4 cu $= I (0.1292 \times 0.9 + 0.0528 \times 0.4357)$
$= I \times 0.1193$

TABLE I—Conductor Resistance and Reactance

Conductor		OHMS Per 1000 ft of Single Conductor							
			Inductive reactance (X) for distance (in.) between conductors						
Size & Kind	Str.	Res. (R), 68 F	3/8	1	4	8	12	15	18
6 Cu, MHD	1	0.4087	0.0409	0.0634	0.0952	0.1110	0.1203	0.1255	0.1296
6 Cu, HD	1	0.4109	0.0409	0.0634	0.0952	0.1110	0.1203	0.1255	0.1296
6 A	3	0.4150	0.0639	0.0621	0.0939	0.1097	0.1190	0.1242	0.1283
4 Cu, MHD	1	0.2570	0.0356	0.0581	0.0899	0.1057	0.1150	0.1202	0.1243
4 Cu, HD	1	0.2584	0.0356	0.0581	0.0899	0.1057	0.1150	0.1202	0.1243
4A	3	0.2610	0.0343	0.0568	0.0886	0.1044	0.1137	0.1189	0.1230
2 Cu, HD	1	0.1625	0.0303	0.0528	0.0845	0.1004	0.1097	0.1148	0.1190
2 Cu, HD	7	0.1658	0.0209	0.0515	0.0832	0.0991	0.1084	0.1135	0.1177
1/0 Cu, HD	7	0.1042	.....	0.0464	0.0782	0.0940	0.1033	0.1084	0.1126
2/0 Cu, HD	7	0.08267	.....	0.0437	0.0755	0.0913	0.1006	0.1057	0.1099
3/0 Cu, HD	7	0.06556	.....	0.0411	0.0729	0.0887	0.0980	0.1031	0.1073
4/0 Cu, HD	7	0.05199	.....	0.0384	0.0702	0.0860	0.0953	0.1004	0.1046
250 Cu, HD	19	0.04400	.....	0.0365	0.0683	0.0841	0.0934	0.0985	0.1027

Balanced Load:

e = 46 × 0.0962 = 4.42 v drop in each hot wire.
The neutral has no current and no drop.

20% Unbalanced Load:

e (hot wire No. 1) = 50 × 0.0962 = 4.81 v drop
e (hot wire No. 2) = 42 × 0.0962 = 4.04 v drop
e (neutral) = 8 × 0.1193 = 0.95 v drop

50% Unbalanced Load:

e (hot wire No. 1) = 55 × 0.0962 = 5.39 v drop
e (hot wire No. 2) = 37 × 0.0962 = 3.56 v drop
e (neutral) = 18 × 0.1193 = 2.15 v drop

100% Unbalanced Load:

e (hot wire No. 1) = 61 × 0.0962 = 5.87 v drop
e (hot wire No. 2) = 31 × 0.0962 = 2.98 v drop
e (neutral) = 30 × 0.1193 = 3.58 v drop

With unbalanced load, differences in voltages at load are greater than the figures alone indicate. The drop in the neutral is added to the drop in the heavier loaded wire. If the unbalance is sufficiently great the load voltage across the lighter loaded secondary side may be higher than sending voltage.

Calculations for voltage drop with unbalanced load may be simplified by calculating the load as balanced and using the proper multiplier shown in Table III.

Condition II—Uniformly Distributed Load

Voltage drop in secondaries uniformly loaded throughout their entire length may be determined by assuming the load to be concentrated at the center of the secondary. Each feed from the transformer is of course a separate problem.

LINE LOSS (I^2R)

Condition I—Concentrated Load

Balanced Load:

I^2R loss (hot wire No. 1) $= 46^2 \times 0.0829 = 175$ w
I^2R loss (hot wire No. 2) $= 46^2 \times 0.0829 = 175$ w
I^2R loss (neutral) $= 0$ w
Total 350 w

20% Unbalanced Load:

I^2R loss (hot wire No. 1) $= 50^2 \times 0.0829 = 207$ w
I^2R loss (hot wire No. 2) $= 42^2 \times 0.0829 = 146$ w
I^2R loss (neutral) $= 8^2 \times 0.1292 = 8$ w
Total 361 w

50% Unbalanced Load:

I^2R loss (hot wire No. 1) $= 55^2 \times 0.0829 = 251$ w
I^2R loss (hot wire No. 2) $= 37^2 \times 0.0829 = 113$ w
I^2R loss (neutral) $= 18^2 \times 0.1292 = 42$ w
Total 406 w

100% Unbalanced Load:

I^2R loss (hot wire No. 1) $= 61^2 \times 0.0829 = 308$ w
I^2R loss (hot wire No. 2) $= 31^2 \times 0.0829 = 80$ w
I^2R loss (neutral) $= 30^2 \times 0.1292 = 116$ w
Total 504 w

Condition II—Uniformly Distributed Load

Line loss on secondaries uniformly loaded throughout their entire length may be determined by assuming the load to be concentrated one third of the distance out from the transformer. Each feed from the transformer is of course a separate problem.

TABLE II—Power Factor

Power Factor, %	Cos θ	Sin θ
100	1.00	0.0000
95	0.95	0.3190
90	0.90	0.4357
85	0.85	0.5267
80	0.80	0.6000
75	0.75	0.6613
70	0.70	0.7141

TABLE III—Unbalance

Load Unbalance, %	Multiplier	
	Neutral Impedance, = Others	Neutral Impedance, 1.5 times Others
10	0.875	0.840
15	0.828	0.782
20	0.786	0.733
25	0.750	0.692
30	0.719	0.657
40	0.660	0.600
50	0.625	0.555

THIS WAY...

Unlike the housewife who uses bread crumbs and other materials to "stretch" the available supply of hamburger, Simplex is not able to add materials to copper to make it go further. We do achieve the same result, but by an entirely different means. Our way is to insulate the copper with Simplex-Anhydrex XX high voltage insulation. It is the very best "copper extender" that we know.

Simplex-Anhydrex XX is a product of Simplex research and development. It is an insulation that is absolutely "tops" in the high voltage field. It is designed to operate at a maximum of 167° to 176°F. (75° to 80°C.) copper temperature, depending on operating conditions. It has all the properties you want in such a high voltage rubber insulation. It will withstand heat. It also withstands ozone and aging, and it is guaranteed not to absorb more than 15 milligrams of water per square inch of exposed surface when tested in accordance with U. S. Coast Guard standards.

So far as we know it is the only insulation of its kind. Use it wherever you have a high voltage problem, whether the cables are to be installed directly in the earth, underground in ducts, under water, or overhead supported from messenger wire.

You can help to "s-t-r-e-t-c-h" the small available supply of copper by insisting that your high voltage cables be insulated with Simplex-Anhydrex XX insulation. Do you want to know more about this unique insulation? Then fill in the coupon below.

SIMPLEX-ANHYDREX XX

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.
GENTLEMEN: PLEASE SEND A COPY OF BOOKLET 1009A TO:

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Joslyn Southwest Co. Photos

FOLDED POSITION eliminates traveling problems. Although only the tower is collapsed here, the platform also folds. Equipment was mounted on this vehicle only during test stages

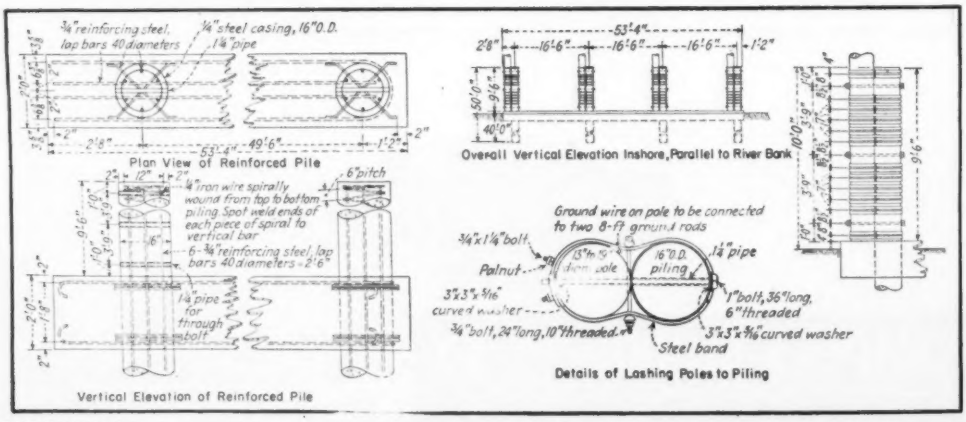
◀ PLATFORM STABILITY, if mounted on a vehicle similar to that at left, is such that the full-extended structure cannot be displaced over a distance greater than three inches

Truck-Mounted Platform Eases Pole-Top Construction

Pole-top construction is relatively simple when done from this truck-mounted platform that can reach heights to about 70 ft, and raise any reasonable load. Also built with a platform that spans a standard H-frame structure, the unit folds in half when in the traveling position.

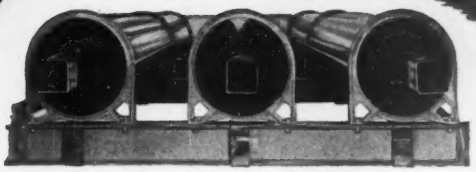
The assembly is built of aircraft steel tubing and can be set up vertically regardless of ground slope. The platform is raised and lowered by cables. It is hydraulically raised and leveled from the traveling to the erection position. The principle involved reportedly makes it impossible for the platform to fall or for the driving mechanism to damage the structure if it should be hung up on any obstacle. Control may be from the ground or by the men on the platform.

River-Crossing Poles Securely Held by Pile Structure


¾"reinforcing steel, lap bars 40 diameters
¼" steel casing, 16"O.D.
¼" pipe
Plan View of Reinforced Pile
6" pitch
¼" iron wire spirally wound from top to bottom piling. Spot weld ends of each piece of spiral to vertical bar
6-¾" reinforcing steel, lap bars 40 diameters = 2'6"
¼" pipe for through bolt
Vertical Elevation of Reinforced Pile
Overall Vertical Elevation Inshore, Parallel to River Bank
Ground wire on pole to be connected to two 8-ft ground rods
¾"x1¼" bolt
Palnut
13"to 15" diam. pole
16"O.D. piling
¼" pipe
3"x3"x5/16" curved washer
¾" bolt, 24" long, 10" threaded
1" bolt, 36" long, 6" threaded
3"x3"x5/16" curved washer
Steel band
Details of Lashing Poles to Piling

FOUNDATIONS for four-pole H-frame structure which carries Southwestern Gas & Electric Co 132-kv line across river. The four poles are set on a concrete pad and lashed to 50-ft steel piling driven 40 ft deep and filled with reinforced concrete. Concrete required is 16.45 cu yd, in a 1:2:4 mix. These are details of Southwestern G&E Co's Red River crossing

REQUIREMENTS FOR A SET OF GENERATOR LEADS



ELECTRICALLY, THEY MUST

- carry the output with but one conductor per phase.
- not exceed a reasonable temperature rise.
- withstand overload without harmful effect to the conductor or its insulation.
- have a tight cover to prevent short circuiting by dust, moisture, etc., on the creepage surfaces of the insulators.
- have a minimum of bolted connections in bus run.
- protect against phase-to-phase short circuits.
- have insulation which is not harmed by heat or age.

MECHANICALLY, THEY MUST

- provide for expansion of bus and cover due to heat.
- withstand vibration.
- be adaptable to installation in congested areas.
- withstand thermal and mechanical stresses without damage or operating failure.
- employ porcelain and metals to their best advantage.

WHEN INSTALLED, THEY MUST

- present an attractive appearance.
- be easily put in place.

FOR INSPECTION AND MAINTENANCE, THEY MUST

- be easily accessible, permitting quick replacement of parts, particularly insulators.
- withstand periodic high-potential tests without damage to insulation.
- protect personnel who may come in contact with bus enclosure.

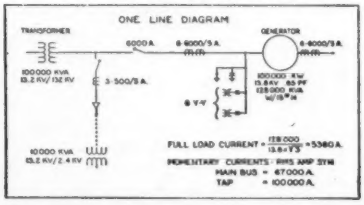
FOR ASSOCIATED EQUIPMENT, THEY MUST

- make provision for mounting disconnecting switches, instrument transformers, and protective devices.

I-T-E ISOLATED PHASE BUS MEETS ALL THESE REQUIREMENTS!

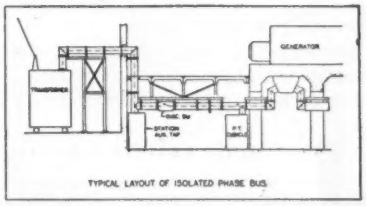
And it's as easy as this to order!

1. Give us a one-line diagram, like this —



2. Plus pertinent information about your building, generator, and transformers.

3. We will quote —



4. And then build *your* Isolated Phase Bus.

For further information, see your local I-T-E Representative, or write

I-T-E ISOLATED PHASE BUS STRUCTURES

I-T-E Circuit Breaker Company • 19th and Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co...

...Eastern Power Devices, Ltd., Toronto...

R&IE

TYPE 1 TYPE 1A

Single or double fan installations with automatic controls. Double operates on single furnace, or serves two. On single furnace either fan can operate up to 70 percent capacity; other fan then cuts in automatically.

TYPE 2

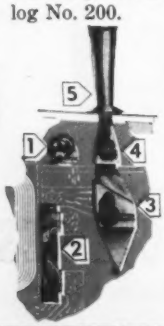
TYPE 2A

TYPE 3

You eliminate fluctuations or losses in draft efficiency by the use of Prat-Daniel Stacks. P-D Fan Stacks coordinate the relationship of fans, breeching and stacks to provide and maintain maximum efficiency.

Thousands of P-D Fan Stacks in long operation have proved their superior reliability over induced-draft fans and stacks purchased separately. Easily applied to any installation, they provide highly efficient draft for the load conditions of your power plant.

Our project engineers provide expert assistance on any problems of draft production and control. Call them on current problems or planned installations. Write for Catalog No. 200.



UNIT RESPONSIBILITY

Prat-Daniel, through its sales and project engineers, The Thermix Corp., offer a complete complement for handling the air gas stream shown at left; 1. Forced Draft Fans, 2. Air Pre-heaters, 3. Tubular Dust Collectors, 4. Induced Draft Fans and 5. Fan Stacks. This unit responsibility, by a well-known firm, relieves the engineer of the responsibility for one of the most important functions in a steam generating plant.

Sales and Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.
1440 St. Catherine St., W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

Designers and Manufacturers

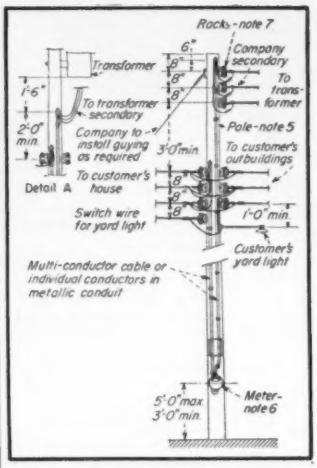
PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

Central Point Distribution Pole Installation Standard

Consumers Power Co has prepared the accompanying construction standard for installing a central point distribution pole on or near a customer's property.

Mounted on the pole are the company's meter, customer's yard light and switch wire, feeders to customer's



EQUIPMENT ARRANGEMENT on a pole used as a central point of distribution on a customer's property. Cable is held to the pole by metal straps placed at intervals. Maximum spacing is 2 ft

house and outbuildings, and, at top, the company's secondary lines.

The following notes apply to a typical "central point distribution" pole installation:

1. All wiring and equipment beyond company owned secondary racks or transformer secondary lead except the meter to be installed, owned, and maintained by the customer.

2. Company will make final connection to its lines from customer's wiring.

3. Side of pole opposite to that shown to be kept clear for climbing.

4. Customer's wiring and equipment shall be grounded independently of any ground installed by the company.

5. Company owned pole shall have 35-ft minimum length with secondary lines only, or 40-ft minimum length with primary lines as in Detail A sketch.

6. Company owns the meter and socket or trough. Customer shall in-

Silver DEPOSITS

INDUSTRIAL BRUSH ELECTRO-PLATING

Is a low-cost, efficient and practical method of applying permanent pure silver* deposits on electrical equipment.

Economy: This original Brush Plating process applies the finest plating possible. Electrodeposits are applied only where the applicator is used. Plating costs can be reduced and placed under complete control.

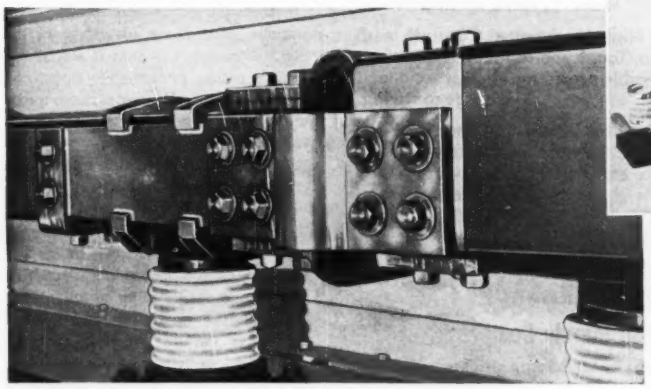
Availability: The efficient power unit and solutions are always ready for instant use — anywhere. Use it on equipment "in place" or during manufacture — No service interruptions.

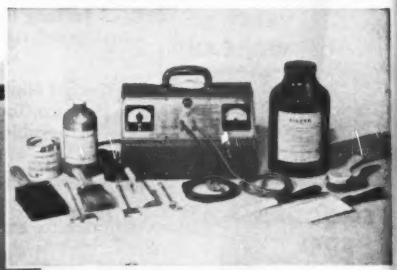
Simplicity: An average worker will learn the correct method of use in less than thirty minutes.

*The electrodeposits of this process are 99.9% plus, pure silver.

- **Brush Electroplating permits rehabilitation of obsolete equipment**
- **insures positive protection to strategic metals**
- **eliminates destructive oxidation**
- **pure silver gives greater electrical conductivity**
- **helps prevent loss of power**
- **gives longer and more satisfactory performance to present electrical equipment**
- **approved and used extensively by United States Army and Navy — Industrial plants and most Power Companies**

*Also applicable for other metals, etc.





NEW LOW group price for complete outfit ready for use as illustrated, only $215.00, f.o.b. Chicago. Brushes are made of Nylon bristles and are unaffected by normal plating solutions. The above installation is all you need for this modern electroplating process.

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SMOOTH BORE CONDUIT

for safe, quick pull-throughs—

with

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8-FT. LENGTHS

YOU WON'T HAVE TO WORRY about short-circuits caused by sheath abrasion when you do your fishing through Bermico Fibre Conduit. The unusually smooth bore of its 8-foot lengths provides a continuous raceway through which cable and wires can be speedily drawn—without injury to their coverings.

Another advantage is Bermico's **Complete Line of Bends,** which, with 5° angle couplings, enables you to meet unusual field conditions.

EASY TO WORK AND HANDLE

Bermico is **Easy to Work and Handle,** too. Its long lightweight lengths can be cut and tooled right in the field . . . make work easier . . . speed up installation.

You get **High Mechanical Strength** with Bermico. Tough and resilient, it offers best possible protection against accidental damage to wiring.

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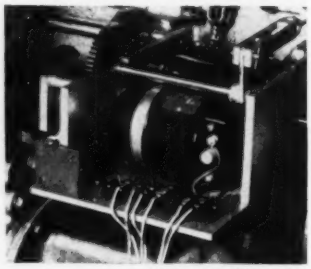
stall socket or trough and furnish any brackets required. Meter must be in true vertical position.

7. Secondary racks are to be attached with lag screws if conductors are No. 3 copper or smaller, and machine bolts are to be used for conductors larger than No. 3 copper.

Electric Governor For Small Generating Plants



U. S. Navy official photo

ELECTRIC GOVERNOR for small generators is designed for improved speed control. It was developed by the Naval Engineering Experiment Station

An electric governor has been designed to permit faster and more constant speed control of small generating plants at all loads. The device was developed by the Welding and Electrical Laboratory of the Naval Engineering Experiment Station, Annapolis, Md. Main advantage of the electric governor is that it starts corrective action immediately upon any change in load. By comparison, a mechanical governor depends on an actual change in speed of the generator before corrective action can take effect.

Basically the electric governor has three actuation elements: A frequency detector circuit, which can be set for the desired corresponding speed; a damping or anti-hunting circuit, which stabilizes the operation; and a load responsive circuit, which is actuated by changes in generator current. The resultant output of these circuits is amplified and fed into a servo-motor which controls the throttle.

While development is not complete, tests indicate that the governor will exceed desired limits. These are: That the governor restore engine speed and frequency to within 0.5% of rated speed within 0.5 sec after change from zero to 100% load and that it maintain load speed within 0.25%.

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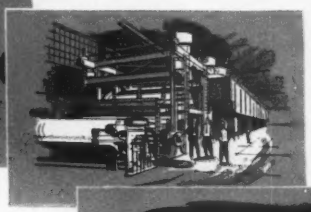

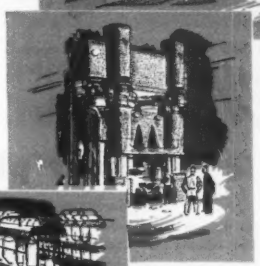

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Through this advanced cooperative plan, Gulf makes available to you the regular counsel of one or more trained engineers, men who are skilled in every phase of petroleum science —men who have years of experience with practically every type of process and equipment employed by industry.

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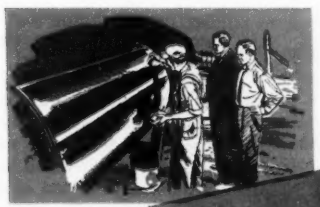

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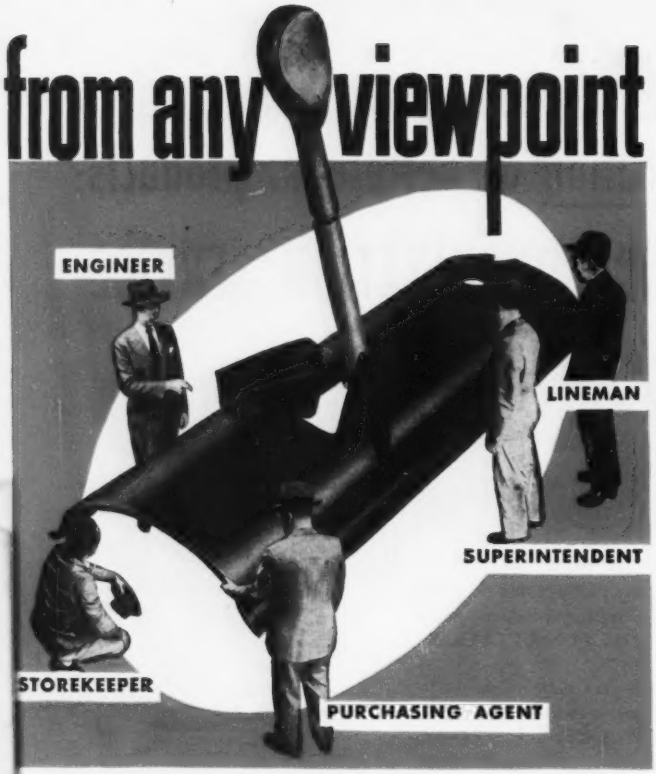


New CHANCE Nevercreep

is the *best* plate ever!

For the greatest possible line security under normal guying conditions—choose the Chance Nevercreep Anchor—it pulls entirely against solid, undisturbed earth.

The New Chance Nevercreep is better from any viewpoint... **Engineers** like the reinforced steel construction with the triple-welded plate that strengthens the area of greatest pull and the dual-purpose creep guards that keep the anchor from creeping up the hole. **Linemen** find the Nevercreep easier to install—the new, larger opening simplifies slipping the anchor over the point of the rod and the creep guards act as a guide for hanging the anchor. The Nevercreep can be installed in machine-bored holes... a definite saving in labor that appeals to **Superintendents.** Lighter weight, ease of handling and stacking are features that **Storekeepers** appreciate... and **Purchasing Agents** get all these advantages without extra cost!

Write for complete information and prices.

ABC INDUSTRIES

No Lemon it's RIGHT when you specify CHANCE

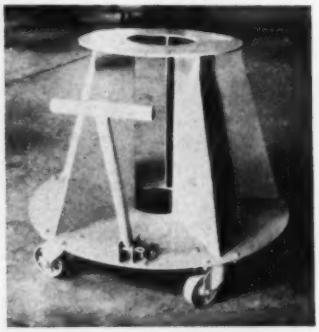
A. B. CHANCE CO.

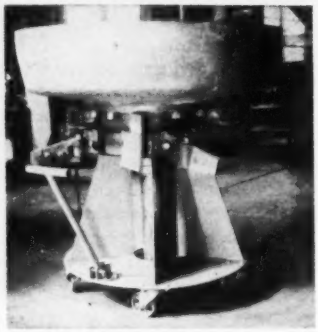
CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

Carriage Moves, Stores Pulverizer Assembly

KELSIE YOUNG
Boiler Maintenance Supervisor
Windsor Plant
Beech Bottom Power Co
Power, W. Va.

Heavy, unwieldy, revolving bowl-and-shaft assemblies from coal pulverizers are moved or stored on this combination carriage-and-holder unit





WELDED CARRIAGE (top) handles and stores pulverizer bowl assembly in a vertical position (bottom)

This unit enables one man to move a 6,600-lb assembly to any part of the plant. It holds bowls vertical while they are being repaired, and provides a convenient method of storing bowl assemblies—protecting shaft and hub.

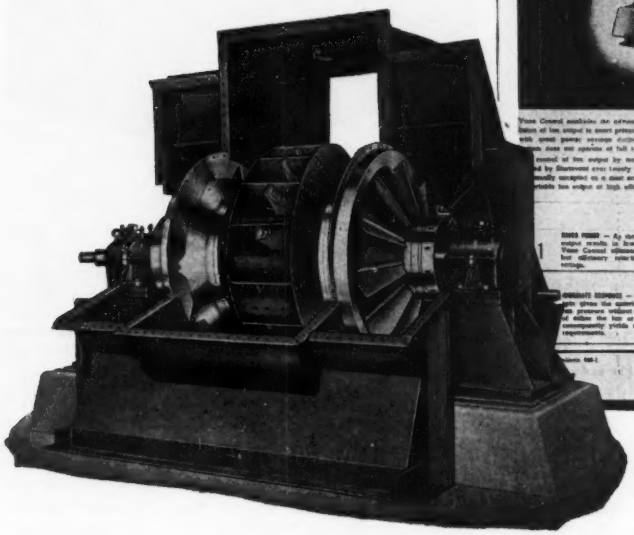
To load or unload the carriage, a jib crane equipped with chain blocks and traveler is used.

The unit was constructed from ⅜ in. steel plates with five fins welded to the top and bottom plates. Top plate is 29 in. OD and bottom plate is 50 in. OD. Five swivelling rollers were bolted to the bottom plate. A 1¼-in. pipe is attached to the bottom plate; a pin at the bottom holds it upright.

A NEW CATALOG...

ON POWER-SAVING

VANE CONTROL®



Cutaway of a Sturtevant Induced Draft Fan shows VANE CONTROL and the E-R (Erosion Resisting) Wheel.

Just off the press, Descriptive Bulletin DB 92-810 gives you complete information and data on the *new* Sturtevant Adjustable Inlet VANE CONTROL.

This power-saving control has been universally accepted as the economical way to obtain variable fan output at high efficiency.

VANE CONTROL's new, easily operable link and lever system is completely outside the gas stream on Induced Draft fans. No abrasive dust ever reaches the operating mechanism.

Sturtevant VANE CONTROL is available for use on Forced Draft fans, Induced Draft fans, Industrial fans, and Centrifugal Compressors. Write today for a free copy of DB 92-810. Address Westinghouse Electric Corporation, Sturtevant Division, 147 Damon Street, Hyde Park, Boston 36, Mass.

YOU CAN BE **SURE**...IF IT'S **Westinghouse**

J-80218

PUTTING *Air* TO WORK

OLD PIT had 100-w lamps in vapor-proof units on 8-ft centers, recessed 6-in. in walls. Extension lights supplemented wall units. Only 5 ft-c resulted—not sufficient for today's needs

Westinghouse Maintenance News

NEW PIT has fluorescent units recessed in walls and tilted slightly upward. Units are staggered, 4 on one wall, 3 on the other. Each unit has 3-40-w white fluorescent lamps

Fluorescent Pit Lighting Aids Bus Maintenance

Repair pit lighting with fluroescent units recessed in pit walls eliminates extension cords and reduces lighting maintenance and explosion hazards at the Cleveland Transit System garage. The quality and quantity of vehicle maintenance has also improved. Pit is 39 ft long and has three fixtures on one side and four on opposite side —staggered on 8-ft centers. Each unit has three 40-w white fluorescent lamps. Average illumination is 25-ft-c. Units are tilted slightly upward. Centers of units are 26 in. above floor.

The pit includes several provisions for protecting the luminaires and other equipment. An overhanging ledge safeguards them from falling tools and oil, and a series of hangers affords a convenient means of keeping tool boxes handy. Plenty of outlets are available for plugging in electrical testing equipment.

Design of installation was made by illuminating engineers of Cleveland Electric Illuminating Co and Westinghouse Lighting Div.

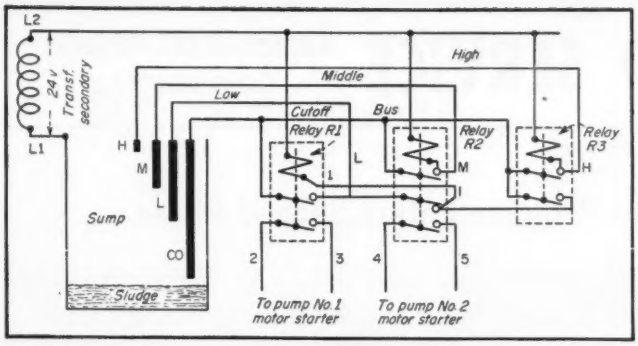
Electrodes Cut Liquid Level Control Costs

FRANK E. REEVES
Director
Electrical Instructions
Baton Rouge, La.

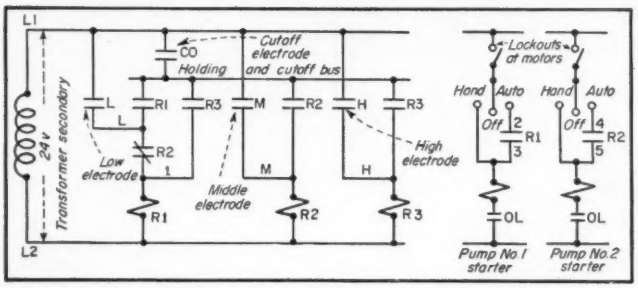
A considerable saving can be effected by using electrodes (or "probes") instead of float switches in a sump pump or other liquid-level-control application. Savings are multiplied when control at more than one level is required. This is the case in the application for which the circuit shown in the diagrams was designed. A further advantage of electrodes over float switches is that they contain no moving parts exposed to the liquid being controlled.

This installation is in a water filtration and treatment plant. The sump is used to dispose of the sludge removed from the water in the filtration process. Amounts of sludge vary widely depending on the amount of silt, etc, in the river from which the water is taken. For this reason, two pumps of different capacities were specified. One pump has a capacity of 50 gpm, driven by a 1½-hp motor; the other is 100 gpm, driven by a 3-hp motor. The smaller unit is used during periods of low demand, the larger unit for moderate demand, and the two units together during periods of high demand.

The circuit in the schematic and elementary diagrams was designed to accomplish this sequence. The sump pit is a metallic tank and one side of the transformer is connected to it. Relays are of the sensitive, low-energy type so as to operate on the current



SCHEMATIC DIAGRAM of control of two sump pumps of different capacities in a water filtration and treatment plant showing how electrodes are used instead of float switches to control sludge level. No moving parts are exposed to the liquid



ELEMENTARY DIAGRAM of same sump pump control using electrodes for sludge level control. Relays are of sensitive low-energy type-operating at 24 v through the sludge. Low voltage is used to reduce shock hazard to personnel

through the sludge at 24 v. The low voltage is used to reduce shock hazard and control circuit is ungrounded for the same reason.

The circuit operates in this way:

1. Assume the "Hand-Off-Automatic" switches are in the "Auto" position. When the liquid rises and contacts the bottom of the CO (cutoff) electrode, no action takes place. When it rises sufficiently to contact the bottom end of the "Low" electrode, coil of relay R1 is energized and seals-in through its own normally-open contact. Another normally-open contact of R1 in series with the coil of the motor starter for pump No. 1 causes that pump to start. If the liquid is flowing into the sump at a low rate, the 50-gpm pump will take care of the flow and the pump will shut down when the liquid drops below the bottom of the CO electrode.

2. If demand increases so that the small pump cannot hold or drop the level, and it rises to the bottom of the "Middle" electrode, coil of relay No. 2 is energized and this relay seals-in through its own normally-open contact. The 100-gpm pump (No. 2) is started by another normally-open contact of R 2. Relay R1 and consequently the motor starter for pump No. 1 is de-energized by the opening of relay No. 2's normally-closed contact which breaks the sealing circuit of R1.

3. If the inflow of sludge is not greater than can be handled by the 100-gpm pump, the level will hold or be lowered. If the inflow is too great for this pump to handle and the level rises to the "High" electrode, coil of relay R3 will be energized and the normally-closed contact of R2 will be by-passed by a normally-open contact of R3. Pump No. 1 is thereby restarted and both pumps will be in operation until the level is pumped below the bottom of the CO electrode.

It is interesting to note that the method of illustrating the electrodes on the elementary diagram is correct since they are actually electrical contacts.

INDUSTRIAL BRIEFS

Core Drying by dielectric heat at the wheel foundry of the American Car and Foundry Co, Huntington, W. Va., produces cores of a finer and more uniform finish than those baked in conventional gas or oil heated ovens. Working conditions are better, since heat is generated within core eliminating external heat. Fumes and vapors are exhausted by means of a blower. Drying time of gluing and coating has been cut from hours to minutes. Considerable space is saved since cooling and storage racks are eliminated as cores may be completely handled, pasted, placed in molds and poured as they come out of the oven. Power input to dielectric heating unit is 34 kva.

Reactivation of Silica Gel Cells used for drying gases is accomplished at Southern Oxygen Co plants at Greensboro, N. C., Kingsport, Tenn. and Bladensburg, Md. by induction heating. The new method has reduced plant hazards to personnel, and has effected an appreciable saving in cost, space and labor. Temperatures as high as 500 F are obtained within cells. At Bladensburg plant, eight silica gel cells are used. Each is wrapped with a 4-kw coil—a total load of 32 kw. Gases were previously dried by caustic soda which was blown out and replaced with new soda after becoming liquefied.—E. P. Shrewsbury, power engineer, Potomac Electric Power Co, Washington, D. C.

Glass Tempering of television tube covers in electrically heated glass annealing furnace has cut operating costs and lowered breakage compared with experience in competitive fuel furnaces at the Dearborn Glass Co, Chicago. Lower initial cost of electric furnace made installation possible for smaller glass processor. Prior to this installation, process was exclusively performed by large glass manufacturers with competitive fuels. Resistance furnace has 300-kw load and thermostatic heat control. Once up to temperature, bulk of load can be greatly reduced. Automatic doors are synchronized with conveyor operation.—E. J. Kern, Commonwealth Edison Co, Chicago, Ill.

SALES AND SERVICE

RESIDENTIAL • RURAL COMMERCIAL

Hotpoint Sales Program Enters Second Phase

Recognizing that the semi-military economy into which the nation is now entering will probably restrict manufacture of electric appliances for an indefinite time, Hotpoint, Inc, feels that production volume will still remain at a level that will allow no relaxation of selling. In this belief, the company is now embarking on a second phase of its program, "Hotpoint Looks at Tomorrow Today", with 4 additional pieces supplementing the original presentation.

One of these is a detailed breakdown of revenue values of all appliances in a complete electric kitchen and home laundry; another an analysis of the advantages of electricity over bottled gas; the third a study of compensation plans for sales work; the fourth a manual to assist in standardizing appliance installations and reducing the costs of them.

Data for the breakdown of revenues are from a survey of domestic appliance uses. A complete average family installation of latest Hotpoint models in kitchen and laundry is estimated to use 7,320 kwhr per year. Some of the low saturation appliances, such as the dishwasher and the clothes dryer, are shown to have excellent load characteristics that contribute revenue without significant addition to investment costs.

PROBLEMS AND VALUES of appliance selling are covered in four pieces supplemental to the original presentation "Hotpoint Looks at Tomorrow Today"

The analysis of bottled gas competition puts at the finger tips of salesmen all of the comparative advantages of electricity in cost, dependability, safety, cleanliness, and efficiency.

The study of compensation covers seven different methods of paying for sales work and discusses the advantages and shortcomings of each. The methods studied are straight salary, commission with a guarantee and with and without drawing account, and combinations of salary with commission, bonus and incentive compensation for specific sales.

The installation manual covers cabinets as well as appliances from uncrating to ready-for-use. Included are plumbing and electrical information in step-by-step installation procedure, generously illustrated with diagrams and cut-away sketches.

Philadelphia's 1951 Sales Plans Are Flexible

The opinion of men in the electrical business in Philadelphia—manufacturers', dealers', contractors' and power company—is that, so far as possible, regular sales promotion activities should be carried on in 1951. Acting on this conviction, three full-scale campaigns directed towards the commercial and industrial market are scheduled. They cover industrial process heating, lighting, and all electricity uses in food stores. They include direct-mail literature and follow-up of leads by power company salesmen. Each campaign will be reconsidered before its scheduled beginning and may be modified or even abandoned as conditions at the time may determine.

This decision to keep on selling was the result of discussion at a meeting of representatives of manufacturers and other groups in the Electrical Association of Philadelphia and of executives of the industrial and retail sales department of the Philadelphia Electric Co.

The three campaigns scheduled for 1951 seem few in comparison with the 10 activities carried on in 1950. But the 10 were comprised of specific applications in heating, air conditioning and lighting. Actually, the 3 cam-

Chemical Brush Control

by the mile!

ESTERON *BRUSH KILLER*

Today, miles of right-of-way are being cleared with Esteron Brush Killer. This widely used Dow formulation now contains more powerful type esters of 2,4-D and 2,4,5-T—effective against a wider variety of brush and weeds and much less volatile than materials previously available. It controls alder, ash, birch, brambles, cherry, elm, hickory, maple, oaks, osage orange, poison ivy, sumac, willow and other hard-to-kill species—also prevents resprouting of stubs and stumps.

Dow has approached brush control problems *from your side.* We are in a position to offer valuable assistance to help you decrease clearing costs—simplify maintenance—and increase efficiency of airplane patrol of power lines. We will gladly furnish you with a list of responsible service organizations engaged in the application of chemicals for right-of-way vegetation control. Write for Booklet IN-168.

Agricultural Chemical Division

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

Also recommended for woody plant control are Esteron 44 and Esteron 245. Where brush is not a problem—2-4 Dow Weed Killer, Formula 40 controls a long list of annual and perennial weeds. For controlling Johnson, quack, Bermuda and other perennial and annual grasses —also palmetto—use Dow Sodium TCA 90%. No fire hazard—and grazing cattle will not be poisoned.

USE DEPENDABLE DOW AGRICULTURAL CHEMICAL PRODUCTS

WEED, BRUSH AND GRASS KILLERS • INSECTICIDES
FUNGICIDES • PLANT GROWTH REGULATORS
GRAIN AND SOIL FUMIGANTS • WOOD PRESERVATIVE

DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY AND AGRICULTURE

paigns cover the same ground as did the 10 in 1950. The difference is that they are not broken down into detailed, pin-pointed promotions.

There are several reasons why the "rifle" technique used in 1950 has been replaced by the "shotgun" method for 1951. Experience in 1949 and 1950 definitely indicated that with the steadily increasing tempo of general industrial activity the pressure of work on salesmen of all branches of the industry will be such as to leave little time for promotional calls. This tempo may further increase and make it impractical to conduct full-scale sales campaigns. And scarcity of equipment may preclude general promotional pressure. Conforming to these ideas the three campaigns were scheduled.

Electric Process Heating

Industrial heating represents the biggest potential market for electricity, and electrical apparatus, and is also the one in which competition is keenest. It was, therefore, felt that full-scale effort to develop this market must be continued. The campaign, begun February 1 and continuing through March, is directed at a broad section of the industrial field and stresses "increased production, quality, and economy" from the competitive angle.

It includes two direct-mail promotional pieces, selective promotional calls by power company salesmen, and cooperative follow-up by them and the manufacturers' sales representatives.

It has been found advantageous, in the long range program, to run one campaign per year covering all applications in a specific business field. For 1951 it was felt that food stores, many of whom are now actively engaged in expansion and modernization, would be the most productive. This campaign will run April 15 to May 31. Two direct-mail pieces covering lighting, air-conditioning, refrigeration, germicidal lamps, etc., are being prepared and will be sent to a representative group of food stores. These will be followed up by promotional calls by utility salesmen and the proper manufacturers will be called in for cooperative follow-up of any good prospects developed. Because of the number of applications covered, and the several groups of the Electrical Association interested, the Philadelphia Electric Co will undertake this campaign on its own, depending on the usual support of manufacturers in follow-through of sales leads.

Lighting Campaign

The fall lighting activity has become practically a tradition and has again been scheduled for September 15 to November 15. Even if at that time there should be a scarcity of lighting equipment, and unless the shortage became very acute, this campaign should still be carried on, directing it to the plants engaged in defense effort. This activity will probably cover industrial, store, office, and exterior lighting. Generally there has been prepared one direct-mail piece to be mailed to all the customers to be covered in the campaign (14,000 in 1950). This was followed up with specialized pieces covering specific applications. It is expected that, as in previous years, this activity will include participation by lamp and fixture manufacturers and be supported by a coincident program of electrical contractors.

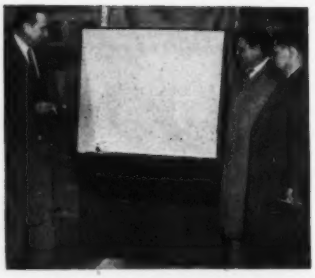
Additional to these "full scale" campaigns, the power company and cooperating groups in the Electric Association will continue established promotional and educational activities. In 1951, these will cover air conditioning and industrial refrigeration, commercial cooking, ultra-violet applications, and ventilation. And the power company will keep on with its regular program of mailings and of normal sales and promotional calls.

Electric Light Traps Reduce Tobacco Worms

L. L. KOONTZ
Rural Sales Supervisor
Appalachian Electric Power Co
Roanoke, Va.

The Appalachian Electric Power Co. has established four one-mile-square demonstration areas to test newly designed light traps for controlling insects harmful to tobacco.

Appalachian is providing the necessary experimental electric traps for test. County Agents and State Entomologist working with farmers in the demonstration areas will weigh results and determine the answers. The demonstration areas will be placed in operation during April early enough



NEW LIGHT TRAP of type under test by Appalachian Electric Power Co for farm use, employs fluorescent tubes and fluorescing backboard. Last season seven similar traps operating only five nights per week during June, July and August, trapped 24,688 harmful horn worm moths. In picture (l to r) are W. A. Pohlman, Gardner Mfg Co, J. E. Collins, AEP Co rural residential supervisor; J. O. Rowell, VPI extension entomologist

to knock down the first flight of moths before they deposit their eggs. Traps will be kept in operation until fall.

During the last two years, exploratory research was conducted at the U. S. Tobacco Experiment Station at Oxford, N. C., under Dr. O. A. Brown using similar specially designed electric light traps to control tobacco horn worm moths. These traps employed fluorescent tubes radiating the major portion of their energy in the near ultra-violet (black light) region, along with a fluorescing backboard to which the moths were apparently blind as they would fly into it at considerable speed and be knocked down through the baffles into the traps.

Seven traps were used last season at Oxford. In one night over 1,500 hawk or tobacco horn worm moths were caught in these traps. Operating only five nights per week during June, July and August, the Oxford traps caught 24,688 identifiable specimens of both the Northern and Southern species of horn worm moths, of which 9,000 were egg bearing females.

These electric traps are not yet available commercially. However, should these test demonstrations check with the limited research results of the past two seasons the traps should be readily available for farmers by another season. It is estimated that the traps may cost in the vicinity of $40 each. It will require about 1¢ worth of electricity per night to operate one of the traps under actual farm conditions in the area.

HOW DO YOU MEASURE THE *VALUE* OF A STATION INSULATOR?

Here's a fundamental fact about station insulators that is so obvious it may escape you. On the *first day* of an insulator's life you measure all of its technical characteristics--but not until the *last day* can you measure its performance. The farther apart these two days can be, the more you get for your money! Actually, what you want most in an insulator--reliability--can't be evaluated until the day you've lost it.

O-B station insulators, like all reputable makes, are built to pass their first-day standard requirements, but what makes them a good investment lies far off in the future.

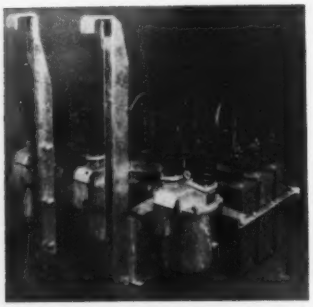
There are so many well-aged O-B installations that you can easily check this fact for yourself; that power companies with 30 to 35 years of O-B experience are the most consistant O-B users today. Because their last day hasn't yet arrived in a full generation, O-B station insulators have proved themselves to give more real value for a dollar. Isn't this a sound basis for putting "O-B" on your own station insulator specifications?

Ohio Brass

MANSFIELD OHIO, U. S. A.

4114-M

NEW EQUIPMENT



Pole-Top Capacitors

Nine 25-kva capacitor units and three solenoid-operated Type CSO-1 switches comprise a small pole-top packaged capacitor bank. Only three line and three control wire connections are needed to put the equipment into service. Recently developed 200-amp, 15-kv load interrupter switch, the CSO-1, makes possible wider use of automatically-switched small capacitor banks.

The unit is available with either nine or twelve capacitors, rated 15 or 25 kva, 2,400 to 7,960 v. Time clock and voltage or current controls can be supplied.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

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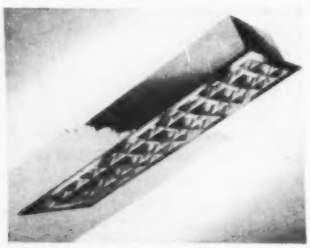


Fluorescent Unit

A recessed louvered fluorescent unit with slanted louvers is designed for use in sloping ceilings over stairways, ramps, and escalators. It is available in both one-light and two-light in all sizes of fluorescent and slimline lamps.

Louvers are tilted at a 30-dg angle to punch light downward over the stair area, yet avoid glare to persons walking up or down the stairs. Loop and hinge-rod device permits lowering louver from either side.

Moe-Bridges Corp, Sheboygan, Wis.

•

Silver-Clad Steel Strip

A laminated strip product consisting of a solid sheet of silver clad on either or both sides of a core of mild steel may be used as a substitute for brass, nickel-silver, nickel, and other restricted metals.

It is available in widths up to 4 in. and thicknesses down to 0.005 in. Manufactured in various silver to steel thickness ratios and rolled, and slit to commercial or precision tolerances, this product can be shaped by stamping, bending, drawing, spinning, and other conventional metal working processes. Component parts can be assembled by means of silver brazing or soft soldering.

American Silver Co, 36-07 Prince St, Flushing, N. Y.

•

Stationary Tachometers

Stationary tachometer Model J-6 is designed for permanent mounting on machines or panels. The face is 5.5 in. diam and is of the centrifugal type, driven by flexible cable. It can be furnished in standard ranges from 10-100 rpm as a minimum to 1,000-10,000 rpm as a maximum.

Special dials can be furnished to read feet per minute, or any other special applications such as gallons, baking time, sheets, etc. Instrument pointer travels in a clockwise direction regardless of drive shaft rotation.

Herman H. Sticht Co, Inc, 27 Park Place, New York, N. Y.

•

Mining Motors

Explosion-proof mining motors in a new line are available in ratings from 0.5 through 60 hp at 230, 250, 500, and 550 v. Stabilized shunt,

compound, or series windings may be had. These motors conform to Bureau of Mines Schedule 2E.

All frame sizes in the line utilize two stud brush mechanisms. Thus, all brushes are accessible through two large handhole covers in the upper half of the commutator end shield. A cable gland design permits cable replacement without removing the end shield or working through the commutator access openings.

General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

•

Industrial Resistors

Resistance element of a new line of resistors is triply insulated from the frame by two thicknesses of mica-fibreglass-silicone, plus refractory porcelain insulators. The steel mounting strip itself serves as the frame for the resistor unit, and operates at ground potential.

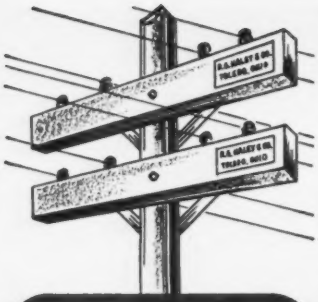
Single resistor units are available in small increment increases from 0.25 ohm at 60 amp to 20 ohms at

whether it's straight line or corner construction . . .
***it calls for* HUBBARD INSULATOR PINS**

Hubbard Wide Base Clamp Pins, Nos. 24320 and 4320 for angle or corner construction, are forged from new hot-rolled open-hearth steel. The broad bases of these pins present a large area to the arm, reducing "burning" and cutting into the wood to a minimum. The four lugs prevent the pin from turning on the arm. They are available in Carriage Bolt and U-Strap types as illustrated. Carriage Bolts and Plate are included with the No. 24320 style.

Hubbard Angle Type Cross Arm Corner Pins, No. 4309 style, are made from certified malleable iron for use on 4 by 5-inch cross arms. The back of the pin (the portion farthest from the bolt) is placed to the inside of the angle of the line, providing a leverage which offers maximum resistance to corner loading. They come with 1 and 1⅜-inch lead threads and for 1⅜-inch thimbles. Mounting Bolt, ⅝ by 6-inch, with washer, nut and lock nut is included.

HUBBARD AND COMPANY
ESTABLISHED 1845
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA
"Hang the Load on Hubbard Hardware!"



CEDAR
POLES
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FIR
CROSS ARMS
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Latest and most modern facilities for
PENTA CHLOROPHENOL TREATING
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LONG LIFE
CLEANLINESS
LIGHT WEIGHT
•
TWO Strategically Located Yards:
Minneapolis, Minn.
Findlay, Ohio

R. G. HALEY & CO.
SPITZER BLDG.
TOLEDO 4, OHIO

5 amp. Rated voltage is 500 v ac or dc. Units may be combined in series or parallel circuits.

Mullenbach Electrical Mfg Co, 2300 E. 27th St, Los Angeles 58, Cal.

•

Measuring Wheel

Exactly four feet in circumference Model 400 Rolatape measures and registers distances up to 100,000 ft, then repeats cycle. Applications include pole spacing, fault spotting, map checking, estimating work involved in utility extensions, conduits, wire requirements, etc.

Weighing only five lb it can be operated by one man and can measure around corners and over contours. A stand holds the wheel upright while operator is logging data. Other sizes available have two and six-foot circumferences. Illustration shows the Model 400 being used while operator drives slowly over the course to be measured.

Rolatape, Inc, Santa Monica, Calif.

•

DC Welder

Advantages of ac welders are claimed to be available with a new dc welder made in two models: 40 to 250 amp and 60 to 375 amp.

Lifting hooks on the side of the welder make it easy to handle with an overhead hoist. Amperage indicator is located on the front of the welder for visibility by the operator from a distance. Standard input is at 220/440 v, three-phase. Knob-type current control and off-and-on switch is located on front panel. Remote current control can be installed. For higher current operation, the units can be paralleled.

Miller Electric Mfg Co, Appleton, Wis.

Variable Scale

Technical problems involving spacing, scaling, proportions, odd scales, plotting, etc, are conveniently solved with this instrument, the heart of which is a calibrated triangular spring. Interpolation interpretation of aerial photographs, and re-scaling of drawing reproductions, without computation are among its many uses.

Gerber Scientific Instrument Co, 89 Spruce St, Hartford 1, Conn.

•

Copper Brazing Paste

Increased strength of brazed joints is said to be secured with a new paste because of the more sluggish molten brazing metal. This improves filleting of joints and eliminates the "notch" effect. The iron-containing Cubond is available with either a water-thinned or petroleum-thinned base.

Thickening effect of iron allows joints to be bridged which might be too wide to be filled by ordinary copper. Clearances to ⅛-in. can be filled, eliminating silver solder jobs.

The Glidden Co, Cleveland, Ohio

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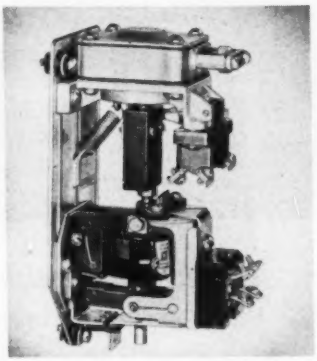


Pneumatic Timing Relay

Designed for timing machine tool cycles, conveyor systems, and similar industrial applications, Class 9050 Type R timing relay utilizes an invertible magnet permitting conversion to delay after energizing or delay after the de-energizing operation. Type RO-9D is illustrated.

The timing range is adjustable from 0.2 sec to 3 min. and is said to be independent of normal variations in voltage, and ambient temperature. Contacts have pilot duty ratings up to 600 v ac or dc. The unit can be fur-

Cut Installation Costs

WITH 30% SMALLER

ROCKBESTOS

A.V.C.®

USE A SMALLER CABLE!

With a 230 ampere load you use Size 000 A.V.C. instead of 300 MCM RH*.

SAVE ON CONDUIT!

You use 2-inch conduit rather than 2½-inch conduit.

SAVE ON FITTINGS!

You use smaller fittings—bushings, couplings, terminators, connectors, etc.

SAVE ON LABOR!

Because the cable is lighter, smaller, you can pull it through the conduit easier, faster, and, of course, *cheaper.*

The more efficient current carrying capacity of Rockbestos A.V.C. means plenty of savings for you. Write for the booklet "Cut Current Carrying Costs."

*Comparison with Type RH, 3 conductors in conduit, 40°C — (104°F). See Chapter X, National Electrical Code.

ROCKBESTOS PRODUCTS CORPORATION

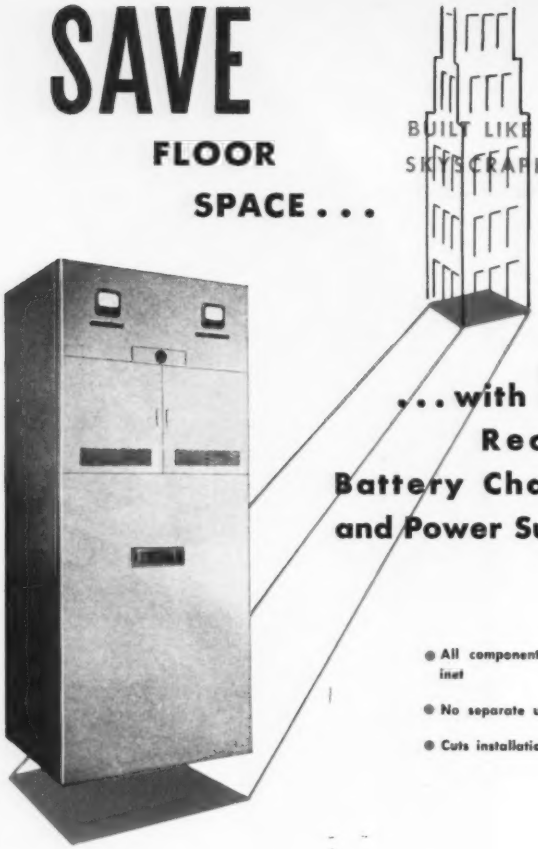
New Haven 4, Conn. • New York • Cleveland • Chicago • Detroit
Pittsburgh • St. Louis • New Orleans • Los Angeles • Oakland, Calif.

Hi I ...Your best buy

*Rockbestos A.V.C. has a Higher Ampere Rating

SAVE

FLOOR SPACE . . .



. . . with PECO Rectifier Battery Chargers and Power Supplies

- All components in one cabinet
- No separate units to install
- Cuts installation costs

INCREASED building costs make the saving of floor space an extremely important factor in any plant today.

That is why PECO rectifier battery chargers and power supplies are built on the "skyscraper" principle to best utilize valuable floor space. For example, the battery charger illustrated here occupies less than 1 sq. ft. per KW, and no special foundations are necessary. Capacities can be increased by operation of two or more units in parallel.

With the many years of experience in the development and manufacture of closely regulated rectifiers of all types, PECO is ready to assist you with your next rectifier application.

POWER EQUIPMENT *Company*

Battery Chargers ☆ Battery Eliminators ☆ D.C. Power Supply Units ☆ Regulated Rectifiers ☆ and other Special Communications Equipment

55 ANTOINETTE STREET / DETROIT 2, MICHIGAN

nished with operating coil voltages up to 600 v ac and 250 v dc. Additional details are in Bulletin 9050-RQ.

Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.

•

Emergency Lamp

Eighty hours of continuous light is said to be provided by Type CDU portable lamp on each battery charge. By use of the second filament of the two-filament bulb, a brighter floodlight may be secured for 20 hours. A thumb-operated three-way toggle switch controls both filaments.

Carpenter Mfg Co, Master Light Bldg, Boston 45, Mass.

•

Solenoid Valve

Even if the air or electrical supply should be interrupted, a new air control solenoid valve is designed to move to a safe position. Operator protection is reportedly increased because all springs are eliminated, and a clapper-type solenoid is used.

Inrush is 4.3 amp at 115 v, holding current is 0.56 amp. Ordinarily, the valve operates with line pressures of 40 to 125 psi. It is available in ¼ to 1¼-in. pipe sizes, straightaway or three-way, normally closed or normally open models.

Ross Operating Valve Co, 120 E. Golden Gate, Detroit 3, Mich.

•

Bismuth Wire

Ductile bismuth wire and ribbon is being produced which, the manufacturer reports, can be used to wind coils, make non-inductive prods, transformers, etc. However, it must be

handled with care due to its low tensile strength.

The following characteristics are said to be significant:

1. Its large resistance change in a magnetic field opens up applications for automatic voltage control, instrumentation, etc.

2. Its large voltage change due to the Hall effect makes it useful for locating ferrous metals, submarines.

3. It is claimed to be the only variable rectifier known.

4. It is the most negative material known for thermocouples, giving −69 μv per deg C change.

A 20-page descriptive booklet may be requested from the company.

Fitzpatrick Electric Supply Co, 444 Irwin St, Muskegon, Mich.

•

Industrial F Fixture

Especially designed for industrial applications, a new fluorescent unit uses two T-12, 430-amp 96-in. single-pin instant-start slimline lamps. It is equipped with a parallel lag-lead ballast, stroboscopically corrected for use where heavy machinery is operating.

Sectional design makes the reflector easy to clean; it is quickly attached by two wing nuts. Push-type single-pin lampholders keep lamps in firm contact. The unit comes completely wired, ready for line lead connections. Operation is from 110-125 v, 60 cycles; 1.75 line amp.

Mitchell Mfg Co, 2525 N. Clybourn, Chicago, Ill.

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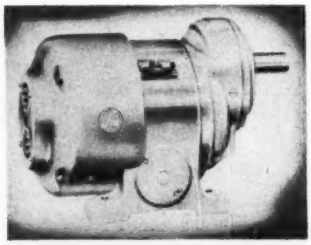


Geared Motor

A new type geared motor is of single-reduction, Klosd-Tite construction for atmospheres containing non-explosive dusts, vapors, and injurious foreign materials. Output shaft ratings are the six AGMA speeds from 780 rpm down to and including 280 rpm. Type FWFA motor is totally

APPROVED FOR R.E.A. USE

No. 1261

SUSPENSION TYPE INSULATORS

Dead End	No. 1261, 6″ dia.
Ball and Socket	No. 1253, 10″ dia.
Clevis Type	No. 1270, 7½″ dia.
	No. 1271, 10″ dia.

REINFORCED WIREHOLDER INSULATORS

Reinforced Type	No. 1937 2¼″ Screw
Reinforced Type	No. 1937-3 3″ Screw

No. 1937

No. 101

SPOOL TYPE INSULATORS

Secondary Rack	No. 101, 1¾″ dia. Groove
Secondary Rack	No. 96, 3″ dia. Groove
Service Rack	No. 100, 1⅜″ dia. Groove

GUY STRAIN INSULATORS

No. 502, No. 534, No. 536, No. 538, No. 540 — Use dependent upon strength and cable requirements

No. 502

No. 175

PIN TYPE INSULATORS

One Piece Pin Type

No. 135 No. 175 No. 253
No. 261 No. 266

Multi-Part Pin Type

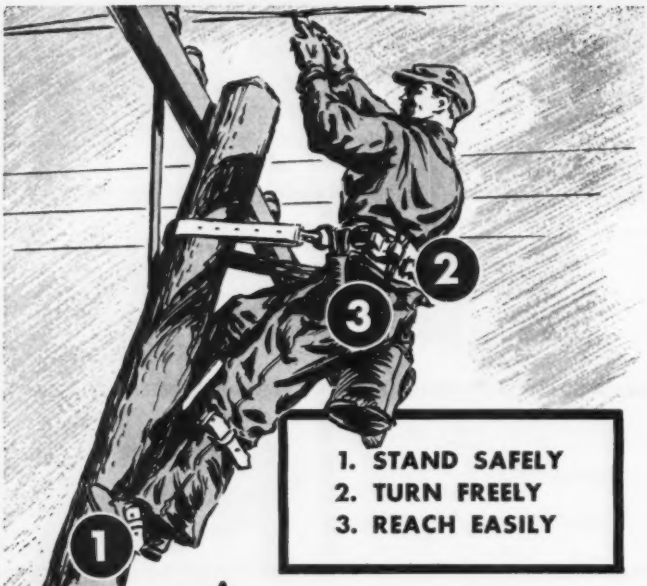
No. 2027 No. 2045 No. 2055

No. 261

DEAD END CLAMPS, SUSPENSION CLAMPS AND FITTINGS

Write for Complete Information and Prices

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS



1. STAND SAFELY
2. TURN FREELY
3. REACH EASILY

with BUCKINGHAM Linemen's Equipment

Every piece of Buckingham equipment is rigorously inspected for quality — rigorously tested for safety — field-proven for comfort and convenience. It's this *dependable* quality and workmanship that has kept Buckingham "on top" for more than half a century.

Adjustable . . . Fits Any Man

1 BUCKINGHAM CLIMBERS

Now — adjustable tops are optional on any type Buckingham Climber! Adjusts from size 15 to 18½—gives every lineman an exact fit, far more comfortable than standard ½-inch sized climbers. Saves on inventory — one pair fits every man on crew . . . practical as extra climbers for service truck, plant, substation. Typical Buckingham quality and safety.

Turns 4½" Right or Left

2 TOOL BELT No. 1060

Glider-type belt allows freer body movement — lineman can turn up to 4½" without constantly shifting feet, binding clothes or cramping tools. Stout, tan-colored harness leather, rolled-edge liner, tough stitching. Typical Buckingham safety and comfort.

"Custom-Made" for Linemen

3 TOOL POUCH No. 4023

Best quality leather tool pouch—holds lineman's three most-used tools. Stoutly riveted. Fits belts up to 2" wide.

That's BUCKINGHAM on Top!

Second to none for
QUALITY
SAFETY
COMFORT

● Write for free Catalog No. 24 showing complete line. Or see one of Buckingham's 660 distributors.

BUCKINGHAM MANUFACTURING CO., INC.
1-3 TRAVIS AVE. BINGHAMTON, N. Y.

enclosed and is cooled with an external fan.

Sterling Electric Motors, Inc, Telegraph Rd at Atlantic Blvd, Los Angeles 22, Cal.

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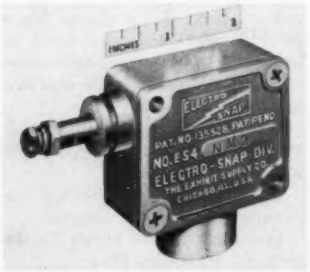


Limit Switch

Limit switch, Series ES4-NM, has been designed for momentarily-pulsed, solenoid-operated valves for air and hydraulic cylinder circuits.

The "on" type length is varied so that, depending on speed of actuating member, an "on" time can be selected that will give 0.1 to 0.2-sec impulse to the momentarily pulsed valve. They are furnished in standard lengths of $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{3}{8}$ in, with "on" time lengths up to $\frac{3}{8}$ in. on special order. A simple flat dog can be attached to cylinder piston rods to actuate this switch. Adjustable plunger head can be lengthened up to ½ in.

The Exhibit Supply Co, Electro-Snap Div, 4218-30 W. Lake St, Chicago, Ill.

•

pH Meter

On the spot pH determinations are possible with this self contained meter. Supports and breakers are eliminated by combining the calomel and glass electrodes with the sample holder in a

single polyethylene probe. It features one-knob control and continuous reading.

The meter is scaled from 2 to 12 pH but an adjustment can be made to provide readings from 0 to 14 pH. The manufacturer states that an accuracy of 0.1 pH is obtainable. Grounded samples can be measured directly since there are no external connections.

Analytical Measurements Inc, 585 Main St, Chatham, N. J.

MORE NEW PRODUCTS
about which you should know

Watts Electric and Mfg Co, Birmingham, Mich., offers a vinyl plastisol dipped **socket assembly** said to be water-tight and dust-proof for use in automobile parking lamps. . . . Howard Industries, Inc, Electric Motor Div, Racine, Wis., has redesigned its Model 800D **shaded-pole motor,** 1/200 to 1/80 hp, for building into products where a separate motor is unnecessary.

National Electric Products Corp, Chamber of Commerce Bldg, Pittsburgh 19, Pa., is making two new **service fittings** for underfloor wiring distribution systems. . . . Crumbliss Mfg Co, 3011 N. Cicero Ave, Chicago 41, Ill., has announced an electric regulator, coil, and condenser tester to diagnose regulator faults in automotive equipment; plugs into 110-v outlet.

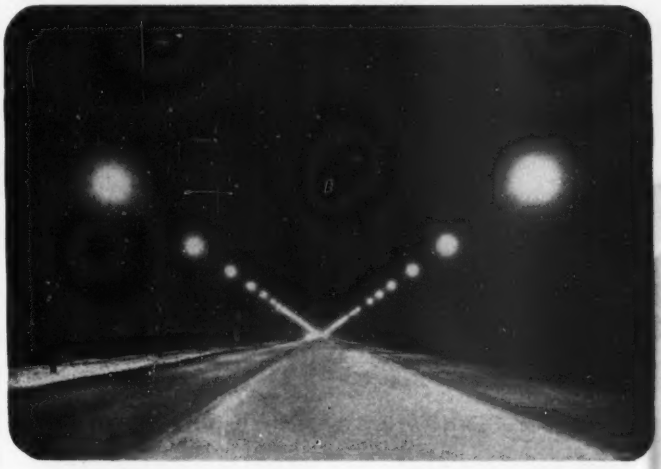
Electronic Tube Corp, 1200 E. Mermaid Lane, Philadelphia 18, Pa., offers H-42A **Strainalyzer** which makes possible simultaneous observation and recording of four separate traces on a single 5-in. oscilloscope tube. Each trace appears in correct time relationship without necessity of optical alignment.

Appleman Art Glass Works, Bergenfield, N. J., is producing a 1,000-w, 115-v **radiant heater** controlled by built-in thermostat; panel measures 27¾ x 23 in. . . . Newage International, Inc, 235 E. 42nd St, New York 17, N. Y., has available a ¼-in. **electric drill gun,** Model S2, for work in industrial plants. Operates on ac or dc, 180 w.

On mile after mile of Chicago streets it's

AMPLEX

STREET LIGHTING LAMPS!



FAR SUPERIOR LIGHTING! Dollar savings never before obtained! That's why more and more American municipalities and public utilities are adopting Amplex Street Lighting Lamps. These lamps are specially designed and built to resist the incessant shocks and jars of traffic . . . to retain the highest degree of light output during the whole of their long-burning life.

Amplex Street Lighting Lamps are made in the most complete line ever marketed . . . give you the right type and wattage for every purpose. And rapidly winning today's leadership are Amplex Weatherproof Lamps formed of "hard glass". Records prove that Weatherproofs virtually abolish failures that are caused by climatic conditions . . . establish completely new standards of dependability and service economy.

For full facts about Amplex Street Lighting Lamps and their outstanding performance, contact Amplex Corporation, Dept. J-5, 111 Water Street, Brooklyn 1, New York.

AMPLEX

Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.

"THIS DATE NAIL TELLS THE STORY"

NLC 24

ERECTED IN 1924... This Koppers Pole is still sound and serviceable!

THAT'S just an ordinary date nail. But, in a sense, it's the symbol of the *kind* of service you can expect from Koppers Poles. The Koppers Pole pictured here was in line for over 26 years—and it's *still* being used.

A number of 30-foot NLC poles were removed recently when a main distribution line was being revamped. They were all found to be in such satisfactory condition that they are being set in yards as lead poles.

Case histories like this are common. Koppers Full-Length Pressure-Creosoted Poles give unusually long periods of continuous service, thereby making line operation easier and more economical.

KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.

This Koppers Pole was part of a distribution system at DeKalb, Texas.

KOPPERS **PRESSURE-TREATED WOOD**

WHAT THEY'RE SAYING
at industry meetings

Lighting Halves Night Accidents

A. F. Dickerson, *manager of GE's Lighting & Rectifier Division, Institute of Lumenology, Lynn, Mass.*

On some of our more dangerous highways the night accident rate is ten times that for the daylight hours. At least half of these after-dark mishaps could be prevented by the use of proper street lighting. A Detroit highway with a night-day death ratio of 7-3 was re-lighted with a resultant drop to a 1-1 ratio. Los Angeles intersection fatalities fell off 92% after lighting correction. Hartford, Conn., cut the death rate of one highway from 32 to 1 through modern illumination. Not only effective in traffic control, lighting has been instrumental in greatly reducing crime. Cleveland acknowledges a reduction of 50% since the streets have been given modern lighting.

Consumption Paces Production

William V. O'Brien, *commercial vice-president of General Electric Co before 17th annual Edison Electric Institute Sales conference.*

The part electrical power plays in the productive power of the country as it goes forward with emergency defense measures can be estimated by the kwhr used by the average American workman. In 1900 he used 1/10 kwhr per man-hour, in 1945 he used 5 kwhr, and by December 1950 his consumption had jumped another 1.75 kwhr, 75% more than had been expected. With this increased consumption has come a nation-wide industrial production increase over the peak years of 1943-44, the equivalent of the product of 1,500,000 workers.

Promotion Tied to Supply

D. A. Packard, *household sales manager, Nash-Kelvinator Corp, before Edison Electric Institute Home Service Advisers meeting.*

Ensuing months may bring confusion in the appliance field with some items in reasonable supply while others are extremely short. This is unavoidable and can be traced to the steel

control order which applies to the manufacturers' production of individual appliances. Nothing is left to the discretion of the manufacturer and no shifting of material from one category to another is allowed. A change in this ruling has been requested but until something is done, confusion is inevitable.

This inequality of supply necessitates alert sales direction. Too strong promotion of items in short inventory can result in embarrassment all along the line.

Salesmen Still Needed

C. B. Boulet, *director of personnel, Wisconsin Public Service Corp before 17th Annual Edison Electrical Institute Sales Conference.*

Recognizing the continued need for salesmen in the industry despite emergency upsets in supplies, sales managers are urged to:

1. Study present force as to continued availability.
2. Plan ahead to adjust force to changing needs.
3. Consider placing excess personnel in other departments where they may be more needed.
4. Select new employees with consideration of present needs and possible future requirements.
5. Train all personnel to meet unusual conditions brought about by the war effort.

Defending Freedom

W. C. Mullendore, *president Southern California Edison Co, Midwest Power Conference, Chicago.*

Indifference and negligence of the leaders in all walks of life are responsible for the growth of the collectivism and concentration of power in the state that are undermining American self-reliance, self-discipline, and independence. The collectivism of "social security," of public ownership, socialization of individual earnings, militarization of the economy, and internationalization of the country as a whole are disintegrating forces. Their effects may be studied in Russia, Europe generally, and now in Great Britain. The past two decades have seen them gain more than a foothold in this country where they are attempting to depose the modern concept of a limited republican government and replace it with the reactionary old-world idea of paternalism.

50% more efficiency

—with RCA 2-WAY RADIO

The AC Portable Carfone (152-174 Mc)—a single-unit radio complete with transmitter, receiver, power supply, portable antenna, mike, and speaker.

Driver talks to dispatcher 10 miles away—instantaneously!

An alert businessman in Conneaut, Ohio, looked for a quick way to boost his net—and found it! Now, with RCA radio, two cars do the work of three. Close control of rolling cars speeds responses—gets car to next point faster—cuts "empty returns." All this, plus a tidy saving on gas, oil and general wear and tear. Here's how it's done.

On his dispatcher's desk, James Camillone set up an AC Portable Carfone—a complete 2-way FM radio like the unit shown above. Then in each car he installed a mobile 2-way Carfone. A simple system. *Yet it provides reliable communication over a 500-square-mile area, 24 hours a day!*

Just one example of how this portable RCA 2-way radio is paying off in transportation, industrial and safety operations. A Pacific coast company uses it to co-ordinate ship unloading. A city in California uses it to control its police and fire-fighting vehicles. A coastal patrol service uses it as a relay in its communication system.

It's a natural for re-routing service trucks on a moment's notice... covers trouble spots and emergencies. It keeps load dispatchers in constant touch with supply sources . . . such as generating stations . . . gas storage areas . . . pumping stations. *Guesswork is eliminated! Outage is reduced! Service is speeded!*

Dept. Q-31
RCA Engineering Products
Camden, N. J.

***FREE**—new book on the RCA AC Portable Carfone*

Send me the new illustrated book about the RCA AC Portable Carfone that operates wherever there's an AC outlet.

Name_____

Company_____

Address_____

City_____ State_____

RCA **RADIO CORPORATION of AMERICA**

NEWS ABOUT PEOPLE

Walker Appointed VP by New England Power

Alfred S. Walker has been elected vice president of New England Power Co succeeding Clifford R. Oliver who has retired.

Walker has been assistant vice president of New England Power, Connecticut River Power, and Bellows Falls (Vt.) Hydroelectric since 1943. In his new position he has charge of the operating and maintenance departments of the wholesale companies of New England Electric System.

A. S. WALKER

Working for the Power Construction Co, Walker helped construct hydroelectric plants for New England Power on the Deerfield River in 1912. A year later he joined Connecticut River Transmission Co, an affiliate.

In 1921 he became superintendent of the company's eastern division at Worcester, Mass. Later he was appointed assistant to Oliver with headquarters at Boston.

Oliver became associated with what is now New England Electric System in 1912 and was active in the electrical engineering phase of New England Power's hydro developments on the Deerfield River. He was made a vice president of New England Power in 1943.

•

H. E. Farrer, has been added to the electrical department staff of the American Standards Association. Farrer retired in 1948 as assistant to the secretary of the American Institute of Electrical Engineers. With the institute for 33 years, he served as secretary of the Standards Committee and as AIEE representative on the ASA Electrical Standards Committee.

•

3 Engineers Promoted by Duquesne Light Co

Duquesne Light Co, Pittsburgh, has made several promotions in its engineering department. R. W. Mavity has been named assistant to the chief engineer, C. T. Sinclair. J. Stanley Brown has been appointed electrical engineer, and Samuel Rosenbach, assistant electrical engineer.

Mavity worked for power companies in the Midwest and the South before joining Duquesne Light Co in 1922 as assistant design engineer. He later became assistant electrical engineer of transmission and distribution and assistant electrical engineer.

Brown has been electrical station engineer in charge of all Duquesne Light power station and substation electrical engineering and design since 1945. Before joining Duquesne Light in 1937, he served as engineer with electrical construction and electric utility firms in New York, Boston, Schenectady, New Orleans, Los Angeles, Washington, and Richmond. Brown succeeds the late F. S. Brown.

Active in transmission and distribution engineering and operation since joining Duquesne Light in 1922, Rosenbach was general engineer in the electrical engineering department at the time of his appointment.

•

Joseph S. Cowan has been appointed manager of government business for National Electric Products Corp, Pittsburgh. He will work out of the firm's Washington, D. C., sales office.

Robert C. Becherer, general manager of Link-Belt Co's plant in Indianapolis, has been elected vice president of the company. He will continue to manage the Indianapolis plant.

Shawinigan Engineering Names Heartz President

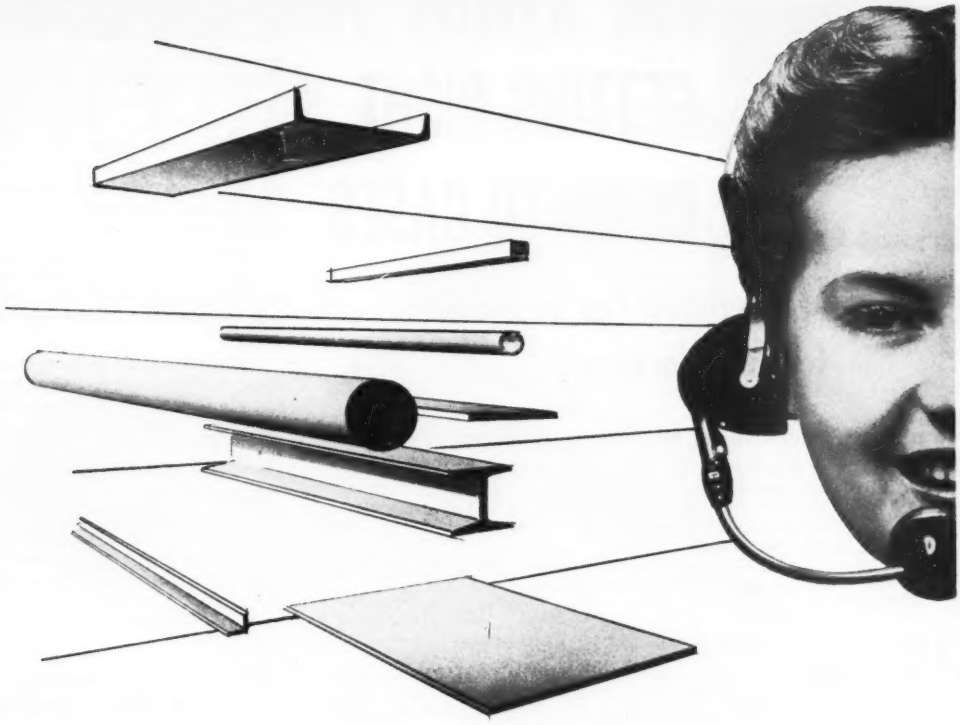
Richard E. Heartz has been elected president of Shawinigan Engineering Co, Montreal, Canada. He formerly was vice president and chief engineer and succeeds James A. McCrory who has been elected chairman of the board.

R. E. HEARTZ

A. L. PATTERSON

Arthur L. Patterson, assistant chief engineer, has been named chief engineer succeeding Heartz.

Heartz joined Shawinigan Engineering Co in 1920 after having worked a year for Fraser Brace Engineering Co on power dam construction. With Shawinigan he served as resident engineer on power developments at Shawinigan Falls, La Gabelle, St. Narcisse, and Paugan Falls.



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CARBON STEEL BARS—Hot rolled and cold finished
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PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot and cold rolled, many types and coatings
TUBING—Seamless and welded, mechanical and boiler tubes
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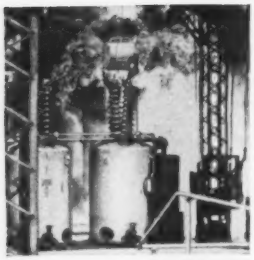


GETTING RIGHT DOWN TO CASES

... in providing fire protection for transformers!

CASE 1 **POTOMAC ELECTRIC POWER COMPANY, Washington, D. C.**

At 5:25 P.M. on Sept. 7, 1949, an explosion blew off the 14" x 36" handhole cover of the high voltage disconnect switch chamber on top of a 20,000 KVA, 36/13.8 KV transformer at the Harvard Street Substation. About 120 gallons of flaming oil were released.

The Grinnell MULSIFYRE System operated at once and saved the transformer from further damage.

CASE 2 **UNION ELECTRIC POWER COMPANY, Venice, Illinois**

At approximately 7:00 P.M. on Wednesday, September 14, 1949, the B phase pothead on the oil-filled high voltage terminal compartment of a 13,800/33,000 Volt, 12,000 KVA feeder transformer failed. The oil drained out of the compartment and ignited.

The Grinnell MULSIFYRE System protecting this transformer had been completed except for the automatic controls. The Deluge Valve was tripped manually and the fire was extinguished "almost immediately, thereby preventing extensive damage to the transformer and adjacent equipment. Damage was limited to $1200."

CASE 3 **NARRAGANSETT ELECTRIC COMPANY, Providence, R. I.**

Early in 1945, drizzle-wetted coal dust, streaking on an insulator, caused a flash-over which ignited an oil spill.

Manual operation of a gate valve turned on the fixed MULSIFYRE System, extinguishing the fire.

Don't take chances! If your transformers are not protected by this emulsion-forming spray system get the complete information by writing to: Grinnell Company, Inc., Providence, R. I. Branch offices in principal cities.

GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

Later he was transferred to the head office in Montreal. In 1935 he was appointed assistant chief engineer.

During World War II Heartz was loaned by Shawinigan to Wartime Merchant Shipping Ltd where he served as general manager for a year. He returned to Shawinigan in 1942 and five years later was appointed vice president and chief engineer of the company.

Patterson started with Shawinigan Engineering in 1919 as a junior engineer and subsequently became office engineer and then assistant chief engineer.

McCrory began his business career in the United States as a draftsman with Crucible Steel Co of America. He went to Canada in 1910 and worked in Toronto for two years before joining the staff of Shawinigan Water & Power Co. Two years later he went to Shawinigan Engineering Co as office engineer. He became vice president and chief engineer in 1935 and was elected president of the engineering firm in 1949.

•

Chanon Named Manager of GE Lighting Institute

Henry J. Chanon has been appointed first manager of the Lighting Institute of General Electric Co's Lamp Department at Nela Park. The institute, formerly an activity of the engineering division, now is a separate division.

The Lamp Department also has appointed new managers for two lamp works. W. M. Miller, who has been head of the East Boston (Mass.) Lamp Works, now is manager of the Mattoon (Ill.) Lamp Works. He succeeds Carl Lenz, who has accepted a position with Locke, Inc, a GE affiliate, at Baltimore. R. J. Johnson, of the staff of the Memphis (Tenn.) Lamp Works, is the new manager of the East Boston Lamp Works.

Chanon, who has had 25 years' experience in the lighting field, has been in the Lamp Department's Buckeye Sales District, with headquarters in Cleveland. He joined GE at Nela Park as a part-time employee. He has served as laboratory assistant in the vacuum tube department, photometry expert in the Engineering Division, movie studio lighting engineer in Hollywood, and fluorescent lamp sales specialist in the General Sales Division. In 1936 he received the

REASONS WHY POWER MEN PREFER
VICTOR SUSPENSION INSULATORS

V CONTROLLED FORMING *plus* smooth, hard glaze give unsurpassed self-cleaning characteristics. Maintenance costs are reduced, especially in contaminated areas.

V ALL METAL PARTS are hot-dipped galvanized to assure maximum resistance to weathering and corrosion.

V SPECIAL "CUSHION" COATINGS at all joining surfaces eliminate problems caused by thermal variations and mechanical shock.

V CONTROLLED TESTING and PROCESSING of cement provide high bond strength at all assembly joints.

V HEAVY OUTER EDGE of porcelain provides added resistance to chipping.

V RUGGED, THICK CORRUGATIONS and smooth, rounded edges give maximum resistance to mechanical impact.

VICTOR NO. 900 SUSPENSION INSULATOR
For complete engineering data on this and other sizes and types of suspension units, write today for Bulletin No. 4.

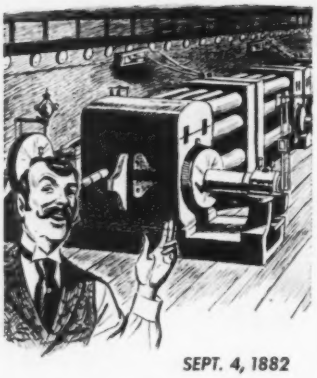
Features like these are just an indication of the vast amount of research and engineering which go into the design and manufacture of VICTOR Suspension Insulators. No wonder power men prefer VICTOR Suspension Units.

Do You Know that...

Every porcelain insulator produced at VICTOR is subjected to the most rigid controls throughout its entire manufacture . . . from laboratory tests on every lot of raw materials to routine high frequency and 60 cycle flashover with modern testing equipment? Result—VICTOR insulators more than meet industry standards.

Specify
VICTOR
SUSPENSION INSULATORS

VICTOR INSULATORS, INC. VICTOR, N. Y.



SEPT. 4, 1882

World's largest dynamos

Capacity: 5,000 lights each

When Thomas Edison opened the Pearl Street Station of the Edison Electric Illuminating Company on September 4, 1882, the station contained the largest dynamos in the world. These six "jumbo" dynamos had a capacity for 5,000 lights each. Fifty-nine users made up the customer list of this first electric lighting plant. Within fourteen months, the company had 508 customers using 12,732 electric lights.

Hemingray started making pole-line insulators twelve years before the Pearl Street Station. It was natural, then, when insulators were needed for newly born electricity, that Hemingray should apply its experience and knowledge to making them. Continuous research and testing, careful quality control and thorough individual inspection through the years have made the name Hemingray synonymous with leadership and progress in glass insulator manufacture.

HEMINGRAY
POWER INSULATORS
AMERICAN STRUCTURAL PRODUCTS COMPANY
Muncie, Indiana

Subsidiary of Owens-Illinois Glass Company

company's Coffin Award for design of a street-lighting system.

Miller joined GE in 1916 at Oakland, Calif. He has been assistant manager of the Cleveland Lamp Works and manager of the Ohio and Bucyrus Lamp Works. Johnson, who started in 1946 as an engineer in the East Cleveland Lamp Works, has served as engineer and assistant foreman at East Cleveland and assistant to the manager at Memphis.

•

Victor Insulators Names Alexander Chief Engineer

David E. Alexander, assistant chief engineer of Victor Insulators, Inc, Victor, N. Y., has been named chief engineer of the firm. He succeeds George H. Schoenthaler who is retiring after 47 years of service in the insulator field.

D. E. ALEXANDER

Alexander joined Victor in 1948 as assistant chief engineer. Prior to that he was a member of the engineering staff of the Jeffrey-Dewitt Insulator Co, Kenova, W. Va., and a field engineer for Minneapolis-Honeywell Regulator Co.

His experience in the power transmission field began with Niagara-Hudson Power Co in 1937. The following year he joined New York Electric & Gas Corp, and later worked privately, specializing in power line and substation inspection.

Schoenthaler started work in the porcelain insulator field with Locke Insulator Co in 1904 as a draftsman. He became chief draftsman in 1910 and 16 years later was made assistant chief engineer.

He left Locke in 1935 to help organize Victor Insulators. With the

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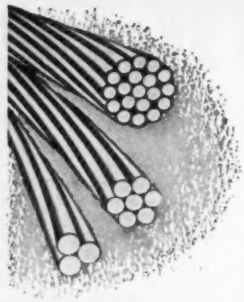

Stainless Steel
STRAND
AND
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CONDUCTORS

Here's WHY they Save

Compared with other types strand of equal breaking strength, they . . .

- **have 30-40% greater overload capacity within elastic limit.**
- **resist corrosion all the way through—not merely through a thin case of soft metal.**
- **offer highest tensile and vibration-fatigue strength (tensile strength 235,000 psi; corrosion-fatigue limit 50% of ultimate).**

Here's HOW they Save

- **They permit longer spans—therefore require fewer poles per mile.**
- **Being lighter, they are easier and faster to install in the field.**
- **More resistant to destructive factors, they last many times as long before replacement.**

Let us tell you the whole story—

specific data, prices, recommended sizes.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

new company he held the position of chief draftsman and was made a director. In 1940 he was named chief engineer. Schoenthaler will continue as a director of the firm and will be available as a consultant.

•

George G. Hanel has been appointed advertising manager of Connecticut Light & Power Co. He joined the company's public relations department in 1944. Previously he had worked in the accounting and operations departments. Hanel is secretary of the Public Utilities Advertising Association.

OBITUARY

Willard E. Herring, 77, consulting engineer and retired Rural Electrification Administration staff member, died at Lookout Mountain, Tenn., April 18. Herring joined REA when it was established in 1935 and assisted in policy formation during its early days. He served as chief engineer, liaison officer, director of operations, and special consultant to the administrator. He held the position of consulting engineer when he retired in 1947. At that time he became associated with the Southern Electrical Corp, Chattanooga, Tenn. Before going to REA, Herring worked for Philadelphia Electric Co, Puget Sound Power & Light Co, and Stone & Webster.

•

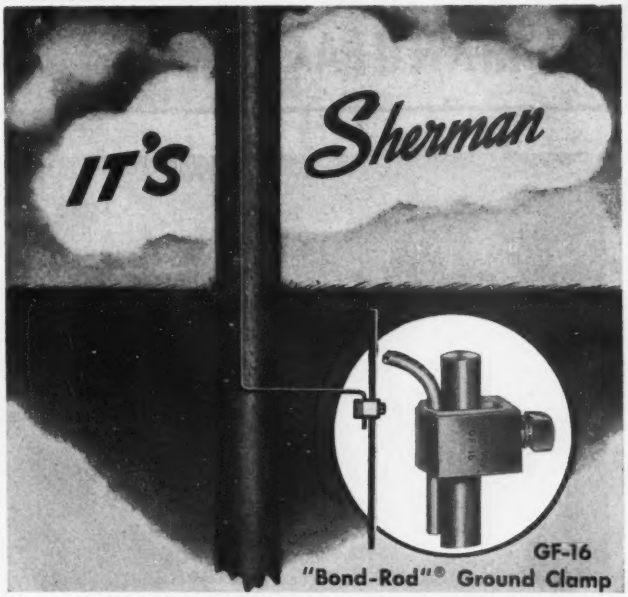
Thomas L. Paden, general supervisor of electrical operations for Pennsylvania Power Co, died at New Castle, Pa., recently. He had worked for Pennsylvania Power and associated companies for 28 years.

Ira S. Davison, 90, director of the Tacoma, Wash., municipal lighting system from 1918 to 1940, died at Tacoma April 22. During his term of office Cushman Dam was built and enlarged.

Robert W. Muller, 60, manager of Pacific Gas & Electric Co's Humboldt division, died at San Francisco April 16. He had been with PG&E since 1912.

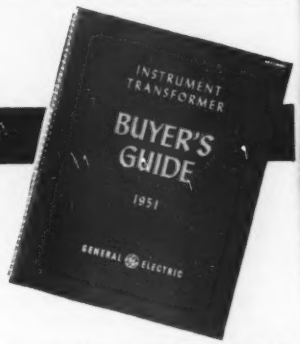
T. W. Long, 64, Boonville manager of Missouri Power & Light Co, died in that city April 19.

"Where DEPENDABILITY Counts . . ."



H. B. SHERMAN MANUFACTURING CO.
Battle Creek, Michigan

JUST OUT.....
1951 EDITION



GET YOUR FREE COPY TODAY!

The 1951 edition of the Instrument Transformer Buyer's Guide contains 82 illustrated pages of basic, up-to-date information on the complete line of General Electric instrument transformers. It tells you everything you will want to know when ordering either indoor or outdoor types—including prices, ratings, and ASA accuracy classifications. It also gives the numbers of supplementary bulletins which you may want to order for more detailed technical information.

The new Buyer's Guide is offered free to anyone who uses instrument transformers. To get your copy, simply fill out and return the attached coupon.

Section 604-27
Apparatus Department
General Electric Company
Schenectady, N. Y.

Please send me the 1951 edition of your Instrument Transformer Buyer's Guide, GEA-4626D.

Name .....
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Company .....
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City ..... Zone ..... State .....

GENERAL ELECTRIC
604-27

MANUFACTURERS and MARKETS

RETIRED GE SPECIALISTS have taken over the job of showing visitors through General Electric Co's "More Power to America Special" exhibit train. Twenty former employees of the company volunteered to serve a three-month stint to relieve 20 young engineers needed by GE in its plants and laboratories

Alcan to Start Work on 1st Phase of British Columbia Hydro Project

Aluminum Co of Canada will begin work on the first phase of its $550-million hydro and refinery project in the Tweedsmuir Park area of British Columbia immediately, with production of aluminum scheduled to start in 1954.

Decision to launch the B. C. project was announced by Nathaniel V. Davis, president of Aluminium Ltd, parent company, who said the development would be carried out as part of a new Canadian expansion program also involving construction of another major hydroelectric power site at Chute Savanne in Quebec's Saguenay district.

First stage of the Alcan project in B. C. will cost $160 million and involve development of 400,000 hp of electrical energy to produce 80,000 to 100,000 metric tons of aluminum annually.

The Quebec project will involve an expenditure of $60 million to develop 200,000 hp. The company already is embarked on a $45-million program to develop an initial site on Quebec's Peribonka River called Chute du Diable—Devil's Falls—to produce 200,000 hp. Decision to build the Chute Savanne powerhouse will permit further increased production of the Saguenay area a year from now.

The two projects will raise Canadian aluminum annual capacity by 150,000 metric tons, bringing total capacity over the 550,000-ton mark.

The B. C. project, in its initial stage, will utilize the waters of Tahtsa and Nanika Lakes, with a 2,600-ft head, ten-mile tunnel dropping water through Tahtsa Mountain range to a powerhouse on the Kemano River.

By proceeding with its project now Alcan is beating the initial development deadline set in the recently concluded agreement (EW, April 9, p 162) with the B. C. government by two years, while a 1954 production start will be nine years in advance of the deadline required by the government. The new agreement recently was ratified by the provincial legislature.

•

Number of Poles Treated in 1950 Near 1949 Level

Almost the same number of poles were treated in 1950 as in 1949 according to preliminary data supplied by the U. S. Department of Agriculture (Forest Service) in cooperation with the American Wood Preservers Association. The respective totals were 6,002,346 and 6,031,746.

Pressure treatment constitutes 85.5% of the total and Southern yellow pine poles comprise 73% of the total. Creosote and creosote coal-tar were used on 84.5% of the poles, creosote petroleum pentachlorophenol on 6%, creosote petroleum on 2.8%, petroleum pentachlorophenol on 2.5%.

The breakdown by species and method of treatment is as follows:

Species	Pressure	Non-pressure	Total
Southern pine	5,350,107	10,956	4,361,063
Western red cedar..	9,943	555,286	565,229
Douglas fir	379,024	25,040	404,064
Lodgepole pine	303,373	90,412	393,785
Larch-Tamarack ...	41,646	73,908	115,554
Northern white cedar	112	87,212	87,324
All other and mixed	65,039	10,288	75,327
	5,149,244	853,102	6,002,346

There were nearly 3 million cross arms treated, and half were Douglas fir; Southern pine constituted 27%.

MANUFACTURING BRIEFS

A guide for power-supplier cooperation in the 4-H Farm and Home Electric Program is presented in a four-page leaflet, "The 4-H Club Year," published by Westinghouse Electric Corp. The leaflet outlines the year-round "learn-by-doing" program of

To turn on current, you need the right kind of switch.

this

not this

Same way with trucks. Get one that fits the job!

DODGE TRUCKS are "Job-Rated" for economy and dependability

Every way you look at it, you save with a Dodge "*Job-Rated*" truck!

You save on gas, oil and upkeep. You save time, work and trouble. That's because each Dodge truck is "*Job-Rated*" for a specific job.

You also get the benefits of more than 50 major improvements in new Dodge "*Job-Rated*" trucks. You get more power than ever, new ease of handling, new riding smoothness.

Remember, too, that you can now get gyrol Fluid Drive —a Dodge "exclusive," available on ½-, ¾- and 1-ton models. It makes driving easier, lowers upkeep costs, lengthens truck life!

See and try these great new trucks. Find out from your nearby Dodge dealer how much you save with a truck that fits your job—a Dodge "*Job-Rated*" truck!

"Job-Rated" TRUCKS DO THE MOST FOR YOU

How a Dodge truck is "*Job-Rated*" for utility operations

A Dodge "*Job-Rated*" truck is engineered *at the factory* to fit a specific job . . . save you money . . . last longer.

Every unit from engine to rear axle is "*Job-Rated*"—factory-engineered to haul a specific load over the roads you travel and at the speeds you require.

Every unit that SUPPORTS the load—frame, axles, springs, wheels, tires, and others—is engineered right to provide the strength and capacity needed.

Every unit that MOVES the load—engine, clutch, transmission, propeller shaft, rear axle, and others—is engineered right to meet a particular operating condition.

WIDE VARIETY
FLEXIBLE DESIGN

Form A-1 indoor bus supports are fabricated from standardized unit assemblies of bus clamps, insulator units, and mounting bases.

Whether for carrying bar, wire, cable or tube conductors, flat or 1¼ pipe mounting, 5000, 7500, 15000 or 23000 volt service the complete line is made up from these unit assemblies.

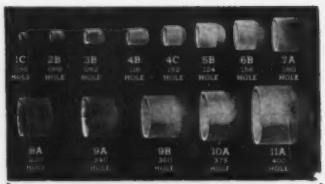
These features mean:

- **Uniformity in manufacture.**
- **Simplified stocking.**
- **Prompter shipment.**
- **Ability to readily change supports when conditions require.**

Specify Three E Form A-1 supports and benefit from these features.

Ask for Bulletin 226 for complete information.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS



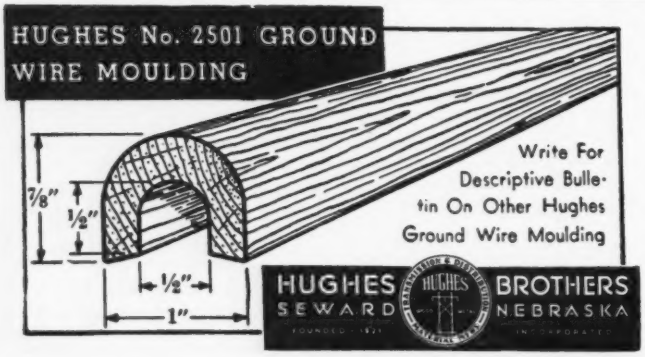
STAR INSULATING BEADS

Use LAVOLAIN ball and socket beads for insulating bare wire. Heat resistant. High dielectric and mechanical strength. Made in U.S.A. Quality heads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

BUY
all the U. S. Saving Bonds you can
and
KEEP
all the U. S. Saving Bonds you buy

HUGHES No. 2501 GROUND WIRE MOULDING



Write For Descriptive Bulletin On Other Hughes Ground Wire Moulding

HUGHES BROTHERS
SEWARD NEBRASKA

4-H club members and suggests ways in which power suppliers can cooperate. Free copies are available to power suppliers by writing School Service, Dept T, Westinghouse Electric Corp, Box 1017, Pittsburgh 30, Pa.

Western Union Telegraph Co has formed a new subsidiary, Western Union Services, Inc, to install and service television receivers. The subsidiary company has been authorized by Allen B. Du Mont Laboratories, Inc, to install and service Du Mont sets in Essex, Passaic, and Union Counties in New Jersey starting in May.

Sangamo Electric Co and officers of the Selco Employees Association have agreed on a new 14-month contract providing for an hourly wage boost of from 1 to 9¢.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co, Milwaukee, has made several sales assignments in its general machinery division. Stanley E. Bovim has been appointed manager of a new branch office in Peoria, Ill. Assisting him in the Peoria office will be F. D. McGuire, Jr, who has been transferred from the Chicago district office. Other representatives named are Loren D. Barre, Portland; Charles Watson, Boston; Donald A. Wooley, New York; Robert W. Butterworth, Syracuse; John E. Watson, Birmingham; James P. Boger, Charlotte; Stephen Hogg, Jr, Atlanta; and Wilson O. Vaughn, Richmond. Charles W. Bloedorn has been named Southeast sales representative for the company's steam turbine department with headquarters in Atlanta.

Graybar Electric Co, New York, has appointed A. A. Wilson manager of its Asheville, N. C., branch office. He replaces H. H. Hix who is on indefinite sick leave.

REPRESENTATIVES

Larkin Lectro Products Corp, Pine Bluff, Ark., has appointed Robert A. Young & Co, 3901 San Fernando Rd, Glendale 4, Calif., representatives for its line of transformers in southern California and Arizona.

Malleable Iron Fittings Co, Branford, Conn., has named Williamson Sales Co, Shreveport, La., as its representative in Arkansas, Louisiana, and Mississippi.

Metal Prices
April 30, 1951

COPPER, Conn. V., lb.	$ .24½
LEAD, N. Y., lb.	.17
ZINC, prime Western, E. St. Louis, lb.	.17½
TIN, Straits, qual. N. Y., lb.	1.42
ALUMINUM, ingot, base price	.19
NICKEL, base price	.50½
STEEL, billets, Pitts., ton	56.00
STEEL, scrap, No. 1 heavy Pitts., ton	45.00

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona—Bureau Reclamation, Dpt. Interior, Phoenix, four 69,000 volt circuit breakers, ten 69,000 volt dis-connecting switches for Davis 69 kv switchyard, Davis Dam Proj. Spec. 300S-22, L. N. McClellan, Bldg. 1A, Denver Federal Center, Denver, ch. engr.

Colorado—Bureau Reclamation, Dpt. Interior, Fort Collins, construct addn. to Fort Morgan sub-station, Colorado-Big Thompson Proj. Spec. 704C-179.

Fla., Jacksonville—Dpt. Navy, Officer in Charge of Construction, Box 5, Bldg. 902, Naval Air Station, overhead power lines to Switzerland Rocket Range from Naval Air Station. NOY 24405-SF-Spec. 26669. Plans deposit $10.

Ill., Wood River—Illinois Power Co., C. A. Steinhauser, div. mgr., 18 E. Lorena St., construct fourth sect. addn. 100,000 kw generating plant. **$20,000,000.**

Louisiana—U. S. Eng., Foot of Prytania St., New Orleans, Zone 9, furnish, installing operating machinery and electrical sys. for Algiers Lock, right bank of Mississippi River, ¼ mi. west of river, 7 mi. southeast of Algiers, CIVENG 16-047-51-186, Orleans Parish.

N. M., Los Alamos—U. S. Atomic Energy comn., Contract Div., Los Alamos, central site facilities, Proj. "P" TA-3 (Inv. No. 291-51-117) electric power, gas water, steam services and telephone conduit all to certain military areas. $100,000. Plans deposit $50.

North Carolina—Virginia Electric & Power Co., 7 and Franklin Sts., Richmond, Va., dam and power house on Roanoke River, **$3,000,000.**

North Dakota, South Dakota, Iowa—Bureau Reclamation, Dpt. Interior, Bldg. 1-3, Denver Federal Center, Denver, Colo., galvanized-steel single circuit towers and appurtenances for Bismarck-Mobridge-Oahe 230 kv. transmission lines, Garrison Dam approach spans and ties to switchyards between Oahe and Sioux City, Missouri River Basin Proj. Spec. DS-3392.

Ohio, Tipp City—Russell Blank, supt. of utilities, Tipp City, imprv. municipal power plant, incl. new diesel units. **$600,000.**

South Dakota—Bureau Reclamation, Dpt. Interior, Huron, construction of Rapid City-Wall-Midland 115-kilovolt transmission line, Schedule No. 1, approx. 54 mi. of line, extending from the site of the Black Hills Powerland Light Co. switchyard at Rapid City to the site of the proposed substation located approx. 1 mi. south of Wicksville and from there to the site of the proposed substation located approx. 7 mi. northeast of Wall; Schedule B, approx. 55 mi. of line, extending from the proposed Wall substation to the site of the proposed substation approx. 4 mi. northwest of Philip, and from there to the site of the proposed substation approx. 2 mi. northeast of Midland. Transmission Div., Missouri River Basin Proj., Spec. No. DC 3387.

Washington—Pub. Wks. Officer, 13 Naval Dist., 1611 W. Wheeler St., Seattle, circuits and equipment to raise transmission voltage on overhead line from Bangor to Keyport from 6.9 to 1.5 kv. Spec. 25499. Plans deposit $10.

Alaska, Anchorage—The Alaska Railroad, Dpt. Interior, Anchorage, heating and power plant. Plans deposit $100. R. A. Sharood, ch. engr.

Low Bidders & Contracts Awarded

Pa., Pittsburgh—H. K. Ferguson Co., 11 at Walnut Sts., Chicago, Ill., Contract Awarded, **$1,000,000,** 1 story 282x502 ft., structural steel frame, concrete factory and work shop, near UNION CITY, IND. Westinghouse Electric Co., Union Bank Bldg.

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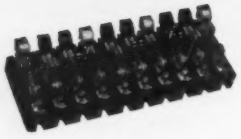

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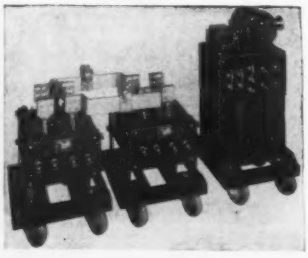

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Ia., Humboldt—Evans Constr. Co., Early, Ia., Low Bidders. **$387,968.** 1, distribution lines; McHugo Constr. Co., Manhato, Minn., **$394,429,** 2, substations, Dickinson, Emmett, Kossuth, Hancock and Hardin Counties, IOWA Corn Belt Power Co-operative. Bids Apr. 4.

Ky., Owensboro—Piper Engineering Co., 925 Liberty Ave., Pittsburgh, Pa. Contract Awarded. **$10,000,000.** Electric furnace steel PLANT, OWENSBORO, KY. Green River Steel Corp.

Mass., East Boston—William Gems & Son, 201 Purchase St., Boston, Mass. Low Bidder. **$360,556.** install electric sys., Logan Airport. State, Airport Management, East Boston, Mass.

Ohio, Toledo—Toledo Edison Co., Edison Bldg., Toledo, O. Own forces. **$161,496.** substation on Baker St., between Cherry and Walnut St.; **$81,604.** substation on Central Ave. west of Reynolds Rd.; **$62,085,** substation on Centennial Rd. south of Sylvania-Metamora Rd. W. T. Lowery, c/o owner, ch. engr.

Oregon—Willamette Iron & Steel Co., 2860 N.W. Front St., Portland, Ore. Low Bidder, **$4,570,460,** intake gates and appurtenances for McNary Dam power house, Inv. No. CIVENG 45-164-51-43, U. S. Eng., 19 E. Poplar St., Walla Walla, Wash. Bids April 17.

Tex., Denton—City, Denton, Tex., Own Forces. **$90,000.** POWER PLANT unit. Joe E. Ward, 545 Nacol Bldg., Wichita Falls, Tex., consult. engr.

Va., Portsmouth — Virginia Caroline Electric Works, Boush & Bute Sts., Norfolk, Va. Low Bidder, **$697,924,** construct rehabilitation and replacement of electrical service at Norfolk Naval Shipyard. Pub Wks. Office, Fifth Naval Dist., U. S. Naval Base, Norfolk 11, Va. Bids April 10.

Wis., Milwaukee—Ray J. Moths Co., 3901 W. Rohr Ave., Milwaukee 9, Wis., Contract Awarded. **$500,000,** 1 story 270x280 ft., steel, brick factory. The General Electric Supply Co., 180 N. Broadway, Milwaukee, 2, Wis. V. K. Boynton, 611 N. Broadway, Milwaukee, 2, Wis., engr.

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Proposed Construction

Calif., Los Angeles—Bd. Supervs., Los Angeles Co., 501 Hall of Records, new juvenile hall, courts etc., $3,050,000. Kaufman & Stanton, 627 S. Carondelet St., and Austin, Field & Fry, 2311 W. 3 St., archts., both in Los Angeles, Calif. Plans deposit $100.

Ga., Jesup—C. C. Mengel Co., 1122 Dumesnil St., Louisville, Ky., paper mill, **$10,000,000.**

Ill., Effingham—Hospital Sisters of the Third Order of St. Francis, Sangamon Ave. Rd., Springfield, 6 story part bsmnt., rein.-con., brick, hospital, $2,000,000. Henry R. Slaby, 2750 N. Teutonia Ave., Milwaukee, 6, Wis., archt.

La., Baton Rouge—Naugatuck Chemical Co., U. S. Rubber Co., 1230 Ave. of Americas, New York, N. Y., plant addn., **$2,000,000.**

Mass., Arlington—Owner, c/o Nathaniel Hamlen, trustee, 11 Pemberton Square, Boston, plans by Sumner Schein, 333 Washington St., Boston, 100,000 sq. ft. shopping center incl. 15 stores, Concord Turnpike, East Arlington, **$2,500,000.**

N. C., Marion—American Thread Co., Kerr St., Fall River, Mass., plans by J. E. Sirrine & Co., 215 Main St., Greenville, S. C., finishing plant. Approx. **$3,000,000.**

Pa., New Castle—School Bd., New Castle, plans by Thayer & Co., 408 Greer Bldg., New Castle, 3 schools. **$3,960,000.**

Tex., Pampa—Celanese Corp. of America, H. Blancke, pres., 180 Madison Ave., New York, N. Y. chemical plant, on Hy. 60, west of here, 435 acre tract purchased. **$8,500,000.**

Low Bidders & Contracts Awarded

Ky., Paducah—United Engineers & Contractors, 1401 Arch St., Phila., Pa. Contract Awarded. **$10,000,000.** Calcium, carbide mfg. PLANT to be operated by National Carbide Co. Air Reduction Co., Inc., 17 and Allegheny Aves., Phila., Pa.

Mass., Brockton—Gust K. Newberg Constr. Co., 2040 N. Ashland St., Chicago, Ill. Contract Awarded. **$17,737,000.** HOSPITAL bldgs. utilities, Manly and West Chester Sts., Veteran's Admin., Technical Service, Munitions Bldg., Wash., D. C.

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CATALOGS • BULLETINS

● CIRCUIT CALCULATOR: Illustrated folder describes Model B-10 circuit calculator which has seven electrical scales for three-phase circuits. Van Halst Calculator, Box 317, Wolcottville, Ind.

● MOTOR FIRES: Bulletin No. 9 explains the effect of dry chemical in putting out fires in electric motors and generators. Ansul Chemical Co, Marinette, Wis.

● AIR SWITCHES; RECLOSING EQPT: Types SW and SWA outdoor air switches, 66-S kv, 600 amp, are described and illustrated in Catalog 114.1. Catalog 511 covers Type MT-3 circuit-breaker reclosing equipment. Pacific Electric Mfg Corp, 5815 Third St, San Francisco 24, Calif.

● RECORDERS: Capacilog line of electronically operated strip chart recorders is described in Bulletin C2-2. Wheelco Instruments Co, 847 W. Harrison St, Chicago 7, Ill.

● LUMINAIRES: Bulletin DR 2 contains data on the Magnalite "Dreadnaught" series, featuring two-lamp semi-direct slimline luminaires. Metalcraft Products, Co, Inc, 306-308 Cherry St, Philadelphia 6, Pa.

● RELAYS: How relay maintenance can be eliminated is explained in Catalog 17, describing H-B mercury plunger relays. H-B Instrument Co, Dept MP24, 2633 Trenton Ave, Philadelphia 25, Pa.

● WELDING ALLOYS: Complete specifications on close to 100 different low temperature welding alloys appear in reference chart TIS 246 P. These alloys are used with steels, cast iron, copper, aluminum, etc. Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y.

● WEDGES: Latest information on both wood and fiber wedges, used to hold windings in motor slots, reduce mechanical hum in transformers, etc, is now available in two short bulletins. Insulation Manufacturers Corp, 565 W. Washington Blvd, Chicago 6, Ill.

● BROODER FIXTURES: Several new electric brooder fixtures for R-40 heat lamps including single- and multi-lamp types for brooding chicks, pigs, and lambs are described in Bulletin 130-51. Steber Mfg Co, Broadview, Ill.

● INSPECTION LIGHT: Bulletin No. 4 concerning the Vaportite inspection and work light is a two-page folder illustrating three sizes of lights, parts details, etc. Commercial Reflector & Mfg Co, 3111 Maple Ave, Los Angeles 11, Cal.

● WELDING: "Welding with Ampco Bronze Electrodes" is a 24-page reference and instruction booklet, Bulletin W-17. Ampco Metal, Inc, 1745 South 38th St, Milwaukee 46, Wis.

● UTILITY EQUIPMENT, ETC: A booklet entitled "This is Thermix" describes the products of companies represented by Thermix. These include Prat-Danniel Corp, Aerotec Corp, and Heacon, Inc. The Thermix Corp, Greenwich, Conn.

● APPLIANCES: "Electrical Living" is basically a planning booklet designed to aid the homemaker in obtaining the highest degree of convenience and comfort from electricity. Westinghouse Electric Corp, Box 237, Pittsburgh 30, Pa.

● ACCOUNTING: Securing accurate financial statements in a hurry, through the use of punch-card machines, is described in "A New Way to Produce Financial Statements." Remington Rand Inc, 315 Fourth Ave, New York 10, N. Y.

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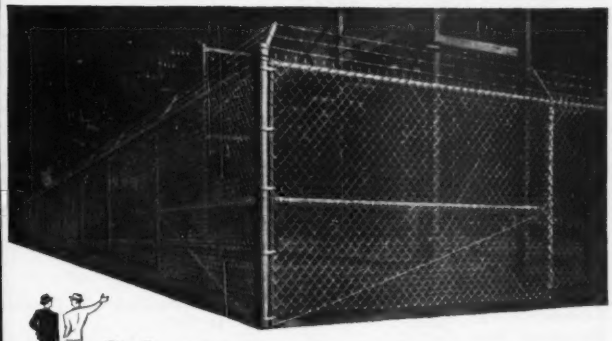

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BOOK REVIEWS

Engineering Profession

Second Edition. The Engineering Profession By Theodore Jesse Hoover & John Charles Lounsbury Fish. Published by Stanford University Press. 469 Pages. Price $7.50

This second edition of this excellent treatise on the engineering profession includes much new material. In the words of the author the changes encompass the following: "construction engineering is raised to the rank of subfield, . . . heat-transfer engineering becomes a subfield (replacing preserving, conditioning, and comfort engineering); and electronics takes the place of communications as the title of a subfield.

There are thirty-nine new tables, representative of salaries and of the functional, industrial, and geographic distribution of engineers from The Engineering Profession in Transition".

This type of detailed analysis of all branches of the profession is an important adjunct to all engineering libraries.

Nuclear Technology

Industrial and Safety Problems of Nuclear Technology. By M. H. Shamos and S. G. Roth. Published by Harper & Bros, New York 16, N. Y. 368 pages, illustrated. Price $4.

The power industry may now have to wait a decade or two before it can utilize nuclear power. However, the physcological and legal problems are so vastly different from any the business now encounters that thought should be given to them. This collection of papers by experts at the 3-day conference at New York University will give a good insight into the compensation and casuality intricacies involved. There is specific information on the exposure hazards and how complex are the methods of minimizing them. This includes also the disposal of waste from the nuclear reactor. Introductory chapters tell how the AEC functions and the rudiments of particle and ray emission.

Servomechanisms

Introduction to Servomechanisms. By A. Porter. Published by John Wiley & Sons, Inc, New York 16. 154 pages, illustrated. Price $1.75.

Servomechanism design and analysis have cloaked themselves with an implementation of mathematics which makes difficulty for a late-comer. This author minimizes the mathematics so that his military students can approach the subject matter by the route of physical principles and applications. Not until then is there resort to quantitative determinations of errors, lags, response and stabilization of performance.

Wireless Communication

Short-wave Wireless Communication. By A. W. Ladner and C. R. Stoner. Published by John Wiley & Sons, Inc, New York 16. 717 pages, illustrated. Price $8.

Two Marconi experts have produced a fifth edition which discards three previous chapters on history, push-pull and diathermy to afford opportunity to introduce new subject matter on sound and vision intelligence, wave guides and telegraph circuits. The primary scope is the 2 to 30 mc bracket and does not include radar or microwaves, although the latter are mentioned. Transmitter and receiver principles are analyzed along with modulation, oscillation and klystrons. Discussions are discriminating and lucid and the treatment is essentially non-mathematical.

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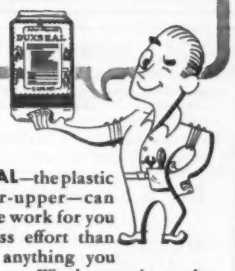

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SANDERSON & PORTER

Engineers and Constructors

New York Chicago
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Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

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THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

SEARCHLIGHT SECTION

Classified Advertising

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** EQUIPMENT: USED OR RESALE

RATES

UNDISPLAYED

$1.20 per line, minimum 4 lines. To figure advance payment count 5 average words as a line. INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of above rate, payable in advance.

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EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style. *Individual Spaces* with border rules for prominent display of advertisements.

The advertising rate is $11.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received in the New York City office by May 11th will appear in the May 21st issue subject to limitations of space available.

WHERE TO BUY

MAINCO DISTANCE MEASURING WHEEL

ONE MAN and a MAINCO can beat 2 MEN WITH A CHAIN

Send for descriptive folder today

THE MAINTENANCE CO., INC.
Dept. A, 453 W. 42nd St., New York 18, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

PROMINENT PITTSBURGH consulting engineering firm has openings for engineers and draftsmen in electrical transmission and distribution department. Utility experience desirable. Positions permanent. Send full details of experience and asking salary to C. C. Knox, Peter F. Loftus Corporation, First National Bank Building, Pittsburgh 22, Pennsylvania.

OPERATING SUPERINTENDENT Large electric public utility requires top flight graduate engineer for central office staff. Duties administration and supervision physical operations, including electrical and mechanical plant betterment and maintenance, of extensive fast growing hydro and thermal electric properties in South America. Required operator with recent broad experience and responsibilities in this work. Position presents challenge and splendid opportunities to ambitious man with these qualifications. Attractive salary. Excellent living conditions. P-9679, Electrical World.

WANTED SALES Engineer for large industrial instrument manufacturer. Prefer Mechanical or Electrical Engineering graduate with a few years industrial instrument experience. Good opportunity with fast growing industrial instrument company. Location: Detroit, Michigan. P-9648, Electrical World.

WANTED EXPERIENCED construction superintendent for stringing large size aluminum conductor on steel towers. Must be capable of organizing and giving general supervision to wire crews on all types of construction. Good pay and steady employment for right man. Write P. O. Box 742, Minneapolis, Minnesota. P-9677, Electrical World.

ENGINEERS WANTED to train as industrial Consultants in Fire Protection Engineering. Full Pay while training for Field Engineering with top U. S. and Canadian Industry. Permanent. Send personal resume to P-9701, Electrical World.

(Continued on following page)

RADIO and COMMUNICATION ENGINEER

Unusual opportunity with large Consulting Firm in New York City for Electrical Engineer experienced in communication systems including telephone, radio broadcasting and ultra-high frequency microwave applications. A knowledge of communications as related to the electric and gas utility industry would be helpful. Please submit resume of experience and personal data to

P-9636, Electrical World
330 W. 42 St., New York 18, N. Y.

ENGINEERS

ELECTRICAL - MECHANICAL - STRUCTURAL

Openings in Ohio and New York offices offering long term employment with good salary for qualified Group Leaders, Designers and Draftsmen experienced in one or more of the following phases of industrial plant design:

Electrical	**Power, lighting layouts and electrical controls.**
Mechanical	**Plant layout, process piping, conveyors, heating and ventilation, boiler houses, process equipment layout, refrigeration, plumbing, tanks and vessels, packaging equipment, special machinery and equipment.**
Structural	**Structural steel and reinforced concrete.**

Please submit complete resume stating experience, education, salary required and availability date.

THE H. K. FERGUSON COMPANY
Engineers and Builders

The Ferguson Bldg. 1783 E. 11th St.
Cleveland 14, Ohio

19 Rector Street
New York 6, N. Y.

ENGINEERS

DESIGN & DEVELOPMENT

Engineers with experience in design and development of distribution cutouts, lightning arresters, indoor and outdoor switches and related equipment: This may be your golden opportunity to relocate at a considerable advantage to yourself.

You may be one of the men for whom a leading manufacturer of distribution equipment, located in the midwest, is looking. If so . . .

You will be offered a permanent assignment in pleasant surroundings.

You will be remunerated in keeping with your experience and ability.

You will enjoy opportunities limited only by your competence.

Your reply will be held in confidence.

Write today:

P-9693, Electrical World,
520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER

Graduate, with five to ten years experience in design of steam and hydroelectric power plants and high voltage substations. Excellent opportunity with large consulting firm in New York for Engineer with satisfactory qualifications. Please send resume of experience and summary of personal data to

P-9635 Electrical World
330 W. 42 St., New York 18, N. Y.

CORROSION ENGINEERS

Wanted by large consulting firm—Corrosion Engineers with minimum of four years experience in corrosion investigations and design of cathodic protection on pipe lines and lead cables in country and city networks. Must be graduate electrical engineer (or equivalent). Work involves extensive travel. Only applicants with above qualifications will be considered. Give full details of education and experience, and references in application.

P-9630 Electrical World
330 W. 42 St., New York 18, N. Y.

ENGINEERS
DESIGNERS & DRAFTSMEN
ELECTRICAL & MECHANICAL

TO WORK IN BOSTON ON POWER PLANT DESIGN

JACKSON & MORELAND

600 PARK SQ. BLDG., BOSTON, MASS.

NEW UNUSED GENERATOR!
1200 KW

1200 KW, 525 VDC, 2290 amp, 750 RPM, 120 V excitation. Type MBC. Shunt wound. Temp. rise full load windings 70°C. Allis-Chalmers Co. Serial No. 144232.

Can be seen here at our plant in Norwood.

TOBE DEUTSCHMANN CORP.
NORWOOD, MASS.

FOR SALE
COMPLETE
STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, with Hoppers, Automatic Coal Conveyors, Automatic Ash Conveyor, 36" x 24" Jeffrey Flex-Tooth Coal Crusher.

1—705 HP Stirling 4 dum BOILER with B&W U-type superheater.

1—10,000 KW Allis-Chalmers STEAM TURBINE.

1—7,500 KW Allis-Chalmers STEAM TURBINE.

1—7,500 KW General Electric STEAM TURBINE.

All with complete control equipment.
Send for complete inventory in Denver.

MORSE BROS. MACHINERY COMPANY
2900 BRIGHTON BLVD.
BOX 1708
DENVER 1, COLORADO

OUTDOOR FEEDER REGULATORS

2—NEARLY NEW 48 KVA, 200 amp, 2400 V, 1 ph, 60 cy, OUTDOOR INDUCTION VOLTAGE REGULATORS—Used 2 years—Excellent condition.

FS-9658 Electrical World
330 W. 42 St., New York 18, N. Y.

POSITIONS VACANT

EXPERIENCED ELECTRICAL Design Engineer required by an established consulting organization for work on continuing program of plant expansion for foreign travel. Preferred age near 40. Permanent position. Attractive salary. Splendid opportunity for right man. Write giving age and fullest details of qualifications and experience. P-9696, Electrical World.

GRADUATE ELECTRICAL Engineer experienced in distribution system planning and betterment work required by an established consulting organization located in New York. Some foreign travel. Preferred age 37-45. Permanent position. Attractive salary. Splendid opportunities. Reply stating age and full details of qualifications and experience. P-9697, Electrical World.

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Sealed bids (Invitation No. DS-3391) will be received by the Bureau of Reclamation, Denver, Colorado, until May 31, 1951, and then publicly opened for furnishing double-circuit steel towers for Oahe- Ft. Randall-Sioux City 230-kilovolt transmission lines, Transmission Division, South Dakota, Missouri River Basin Project. Delivery is desired within 600 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Sealed bids (Invitation No. DS-3392) will be received by the Bureau of Reclamation, Denver, Colorado, until May 22, 1951, and then publicly opened for furnishing single-circuit steel towers for Bismarck-Mobridge-Oahe 230-kilovolt transmission lines, Garrison Dam approach spans and ties to switchyards between Oahe and Sioux City for Transmission Division, North Dakota-South Dakota, Missouri River Basin Project. Delivery is desired within 600 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

To EMPLOYERS who advertise for MEN:

WHEN there are many applicants for a single position it frequently happens that the only letters acknowledged are those of the most promising candidates. Others may not receive any indication that their letters have even been received by a prospective employer much less given consideration. These men often become discouraged, will not respond to future advertisements, and sometimes question their bona fide character.

Every advertisement printed in the Searchlight Section is duly authorized.

It will help to keep our readers interested in this advertising if you will acknowledge every application received, even if you merely return the letters of unsuccessful applicants with, "Position filled, thank you" written or stamped on them. If you don't care to reveal your identity, mail them in plain envelopes.

We suggest this in a spirit of cooperation between employers and the men replying to Positions Vacant advertisements.

★

Put yourself in the other fellow's place."

★

Classified Advertising Division

McGraw-Hill Publishing Co., Inc.

FOR SALE — WILLIAMS DIGGER

Model P.D. I with Waukesha Motor for drive, 8", 10", and 24" augers and pulley assembly for setting poles; mounted on 1942 M2, White Half-track with winch; new tracks March 3, 1951. Unit has dug approximately 5000 holes.

Northern Electric Cooperative Ass'n.
Virginia, Minn.

WANTED

WANTED
- Watthour Meters
- Meter Parts
- Transformers (instr. current)
- BX cable

ATLANTIC ELECTRIC METER CORP.
214 E. 41 St., New York 17

SCHOOLS

A COMPLETE HOME COURSE IN
ELECTRICAL CONTROL
Write for full particulars to
ELECTRICAL INSTRUCTIONS
DEPT. 110
P. O. Box 5177 Audubon Station
Baton Rouge 6, La.

A. C. POWER

3–150 K.W. DIESEL GENERATOR SETS

Buckeye–600 r.p.m.–medium speed Westinghouse generator–440/3/60–complete with modern dead front switch gear. Units equal to new–used only 50 hours.

IMMEDIATE DELIVERY

Write—Wire—Phone

THE

BOSTON METALS CO.

313 E. Baltimore Street
Baltimore, Md.
LE 1980 **CU 5050**

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

EBASCO SERVICES INCORPORATED
(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

NEW
Guaranteed Rebuilt
MOTORS-GENERATORS-CONTROLS
NOW IN STOCK
We buy surplus equipment
L.J. LAND Inc.
Box 756 Reading-5Pa.

DIESEL POWER

FOR

IMMEDIATE SHIPMENT

UNIT CAPACITIES—10 TO 1875 KVA

A.C.—50 AND 60 CYCLES

VARIOUS VOLTAGES

A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	33F16	2000	300	375	Enterprise	DSG–6	450	480
1420	Fairbanks Morse	38D8⅛	1600	720	330	Superior	KNA	396	514
1250	General Motors	16–278A	1600	720	312	General Motors	8–268A	450	1200
937.5	General Motors	12–567	1080	720	312	Clark	MD–4	376	327
625	Alco	6–12½x13T	750	600	125	Ingersoll Rand	8	225	514
425	Baldwin	VO–6	510	450	187	General Motors	8–268A	150	1200
400	Buckeye	80	480	600	75	General Motors	6043C	90	1200

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.

ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS

Qu	KW	Make	Desc.
2	750	G.E.	Condensing — 425 lbs. 750 TT. I.S.P. 440v. 3 ph. 60 cy —Built 1944
1	625	Westg	Non-cond. 125 lbs. I.S.P. 5/20 lbs. B. P 440 v. 3 ph. 60 cyc.
1	400	Westg.	Non-condensing—125/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

	KVA	Make	Type	Volts	Speed
1	6140	Whse.	TSC	2400/4150	600
1	4000	G.E.		2400/4150	900
1	3000	Whse.		2400/4800	720

MOTOR GENERATOR SETS
3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
2	2000	G.E.	500	600 25 cy	11000
2	1800	G.E.	600	125/250	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1000	Whse.	900	600	4150
1	1000	G.E.	900	600	2300/4150
1	750	G.E.	900	275	4150
1	750	Whse.	900	275	2300/4150
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300
1	400	G.E.	720	250	440/2300
1	350	G.E.	900	125	4150

TRANSFORMERS—60 Cycle

	KVA	Make	Type	Ph	Voltages
2	4000	G.E.	HT	3	22000x2300
2	2666	Whse.	OISC	1	66000x11000
3	1250	G.E.	HVDDJ	1	6900x2580
3	333	Pitts.	OISC	1	36400x2600
6	250	G.E.	HT	3	13200x240/480
12	200	G.E.	HT	3	2400/4150x240/480

BELYEA

COMPANY, INC.

OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

—TRANSFORMERS—

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes. *One Year Guarantee.*

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
1—1000 KVA G.E., 3 Ph., 4150V, 2 Ph., 2400V
3— 400 KVA G.E., 1 Ph., 6900V, 2300V Sec.
1— 200 KVA G.E., 3 Ph., 2400V 220 Sec.
1— 150 KVA G.E., 3 Ph., 4150V 120/208Y
6— 50 KVA G.E., 1 Ph., 13,450V, 120/240V Sec.
6— 25 KVA G.E., 1 Ph., 440/220, 220/110 Sec.

WELDERS

2— 500 Amp. Westinghouse Flex Arc Welders 220/440 sing. phase

MOTOR GENERATOR SETS

1—1000 KW G.E., 600 V, 514 RPM, 4000V Syn.
1— 175 KVA West., 1 Ph. 220V, Motor 3 Ph. 440V
1— 150 KW G.E., 125/250V, 1200 RPM, 2300 Syn.
1— 100 KW El. Mchy. 125V, 1200 RPM 4150V Syn.
2— 40 KW El. Mchy., 125V, 1200 RPM, 440 S.C.

SLIP RING MOTORS

1—2500 HP G.E., MT, 257 RPM, 6600V
1— 250 HP West., CW, 600 RPM, 440V

SYNCHRONOUS CONDENSER

1—2500 KVA Whse., 720 RPM, 2200V with D.C. Exc.

Large Stock of A.C. and D.C. Equipment

LETTERS TO THE EDITOR

Up Transformer Loadings

To the Editor:

In a recent editorial you urge combined engineering effort to further reduce the amount of copper from generator to load now required.

We set a record in this in the last war, rationalizing equipment, design and application, cutting down on materials all along the line. We should be able to improve on that record if we put in the effort.

The following suggestion, though it entails a relatively small possible saving, (about 5% in the copper of the transformer) is a starter in the hard business ahead.

Studies conducted on insulation as such and on complete transformers at temperatures well up to 105 C point definitely to the feasibility of good economic life of the insulation at these temperatures, more so when residues originally present in the insulation body or liberated as the result of operating at the higher temperatures are given ample opportunity to escape from the insulation. The removal of these residue products and the continuous purification of the insulation by such means as for instance thermosiphon filter circulation of the oil through activated clay or alumina—in combination with inhibitors if need be —will permit the operation of modern transformers at temperatures above levels now recognized in the present operating guides.

Through these or other equally effective measures, the possibility of operating transformers continuously or for long periods of time at temperatures estimated at least 5 degrees C above present so-called normal 95 degree C hottest spot copper, appear feasible and economical. Leads, bushings and tap-changing equipment, all will require proper proportioning if full advantage is to be taken of the increased load capability available in the transformer proper.

The proposal outlined essentially is to liberalize the present operating guides in view of the critical situation, taking the fullest advantage of the inherently better load capability obtainable from transformers of modern design. No change in the standards proper is here proposed. By such measures, it is estimated that for the same equipment the effective kva loading can be increased at least 5% with a corresponding if not greater saving in critical materials, as copper, iron, oil and insulation.

P. L. Bellaschi

Consulting Engineer
Portland, Oregon

Button Normally Closed

To the Editor:

I wish to call attention to the diagram on page 156 of the Feb. 26 issue of "Electrical World." The diagram still is wrong. The stop button is open and must be closed at all times. You could not start [the motor] with the stop button open.

Harold P. Hickey

Utility Service Corp
Rahway, N. J.

To the Editor:

In regards to corrected "Indicating Light Circuit" illustrated in the Feb. 26 issue of "Electrical World," it is impossible for the coil to remain energized when the start button is released. I would suggest a normally closed contact for the stop button instead of normally open as illustrated.

George J. Wilson, Jr

Electro Construction Co
Philadelphia, Pa.

(Editor's note: Readers Hickey and Wilson are right of course.)

Co-op Didn't Cooperate

To the Editor:

I have been reading in your magzine concerning the growth of REA cooperatives. I can't make up my mind whether such growth is good or bad. Some experiences I have had during the past year with a cooperative down in Indiana have been far from pleasant.

I bought some land in Fountain County last spring and . . . got in touch with the local cooperative which has a line along my property. I was told that as soon as I paid a $5 membership fee, a $2.50 inspection fee and a $10 meter deposit I would be given service. This was May 16. I lost no time sending them a check and promptly received a receipt.

When the power had not been brought in by the middle of June . . . I was told that something had happened to my papers. I was told not to worry, the power would be brought in the next week. The power was not brought in that week so I ran a temporary line to a neighbor. The second week of July the cooperative installed a meter pole for me. Two weeks later they installed a transformer and brought in the service drops. The voltage drop through the temporary line was too high for comfort and resulted in the burning out of [an] electric hand saw.

August came and went. No additional service. Then a cooperative inspector took a look at my service connection from the service drop to the meter. I had asked for permission to install two No. 2 hot wires and a No. 4 neutral. But the inspector said no, despite the manager's previous okay. I had to pull [these wires out] and install three No. 6 wires. I still don't know why; I was using 1½-in. conduit . . .

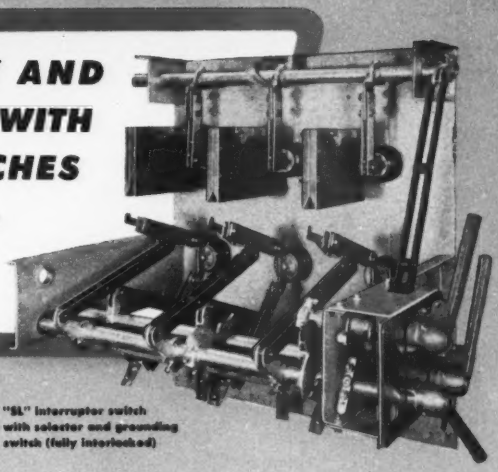
In September I told the manager that if he did not intend to give me any service to please refund my money and I would install my own power. Finally, October 16, I was connected to the cooperative line, exactly six months from the time I was promised power.

I still wonder sometimes if [it] wouldn't have been just as well to have installed my own power. The cooperative power is anything but reliable. The power has been off at least 13 times since last May. Several times it was off from an hour to all day. The crowning irony was the receipt of a monthly bulletin the cooperative publishes, [which] took great pride in the low number of "outages." Their total for the year was less than those I was aware of on our own line.

Lee Wilcoxon
Electrical Contractor and Engineer
2921 Simpson Street
Evanston, Illinois

GREATER FLEXIBILITY AND LOW COST PROTECTION WITH "SL" INTERRUPTER SWITCHES

Not just an interrupter—not just a disconnect —but a combination that breaks loads safely—and when equipped with power fuses you get full system protection.



"SL" interrupter switch with selector and grounding switch (fully interlocked)

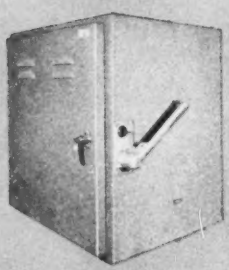
When specifications call for opening of circuits under moderate load you will find Delta-Star type "SL" interrupter switches will meet the requirements perfectly. Used with power fuses, they provide an economical means of fault protection. Standard or special arrangements are all designed, manufactured and tested to operate as an integral part of your system equipment.

Units are available in voltage ratings of 5, 7.5 and 15-kv. with interrupting capacities of 400, 200 and 100 amperes respectively. Continuous capacity of switches may be as desired since the main switch is independent of the interrupter. Furnished with or without metal housings in single, two or three pole units for mounting on transformers, walls or structures.

Load interruption is accomplished by momentarily shunting the full load current through a by-pass circuit. Here the arc is extinguished by rapidly elongating it within a confining chute. Danger of external arcing or contact burning is eliminated.

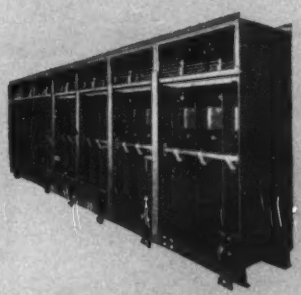
For complete information consult our nearest representative or ask for Publication 4612

THERE IS AN "SL" INTERRUPTER SWITCH FOR EVERY APPLICATION



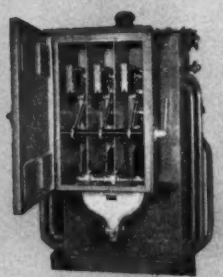
Heavy gage steel cabinets for both indoor and outdoor service

Large doors provide easy access to equipment for inspection and maintenance. Door handles on all indoor metal enclosed units are of the key type. Padlock clips are provided for locking handle in open or closed position.



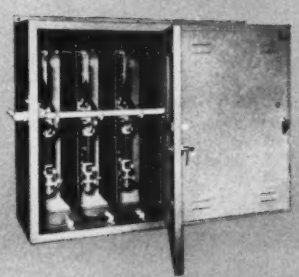
Long bank of three-pole interrupters

Whether you require this type of installation or a single pole unit, "SL" interrupters meet every requirement. Provision for mounting key interlocks is standard on all equipment. Interlocks can also be furnished where sequence operation is desired.



"SL" interrupter switch mounted directly on transformer

Terminators can be arranged on top or bottom of interrupter housing and furnished in several different arrangements for single feeder, looping circuits, etc. Units are easily operated by direct handle or hook-stick as preferred.



Interrupter in combination with power fuses for fault protection

Each operating handle is equipped with a latch to prevent blade opening under short circuit currents. The latch is released by means of a trigger located on the operating handle and can be padlocked to prevent unauthorized operation.

DELTA-STAR ELECTRIC COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

2437 Fulton Street • Chicago 12, Illinois

DISTRICT OFFICES IN PRINCIPAL CITIES

Over 250,000-KW Capacity Operating on . . .

NONPAREIL
TRADE MARK
Turbine Oil

● With the installation of a 45,000-KW turbine shown in the foreground of the illustration above, a large midwest utility now has six large turbines — over 250,000-KW capacity — operating on NONPAREIL Turbine Oil.

There is reason to believe that this new turbine will never have to be shut down for oil replacement, oil-system cleaning, or because of oil-acidity troubles. This conviction is based on the lubrication record of NONPAREIL Turbine Oil in this plant.

During *ten years of operation*, neutralization numbers have stayed below .07 mg. KOH/gm. There have been no time losses or troubles caused by high acidity. Oil systems have stayed clean. Such benefits are assured this company, not only for 10 years, but for the *life* of its turbines. This assurance is based on NONPAREIL's written guarantee that it will maintain a neutralization number below 0.15 mg. KOH/gm.

WITH NO OIL-ACIDITY OR OIL-REPLACEMENT WORRIES

Why not end oil-system maintenance and oil-acidity troubles once and for all, by using NONPAREIL Turbine Oil in your turbines? For more evidence of these savings, ask a Standard Oil Lubrication Engineer to supply you data from 23-year service records of NONPAREIL Turbine Oil.

• • •

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

STANDARD